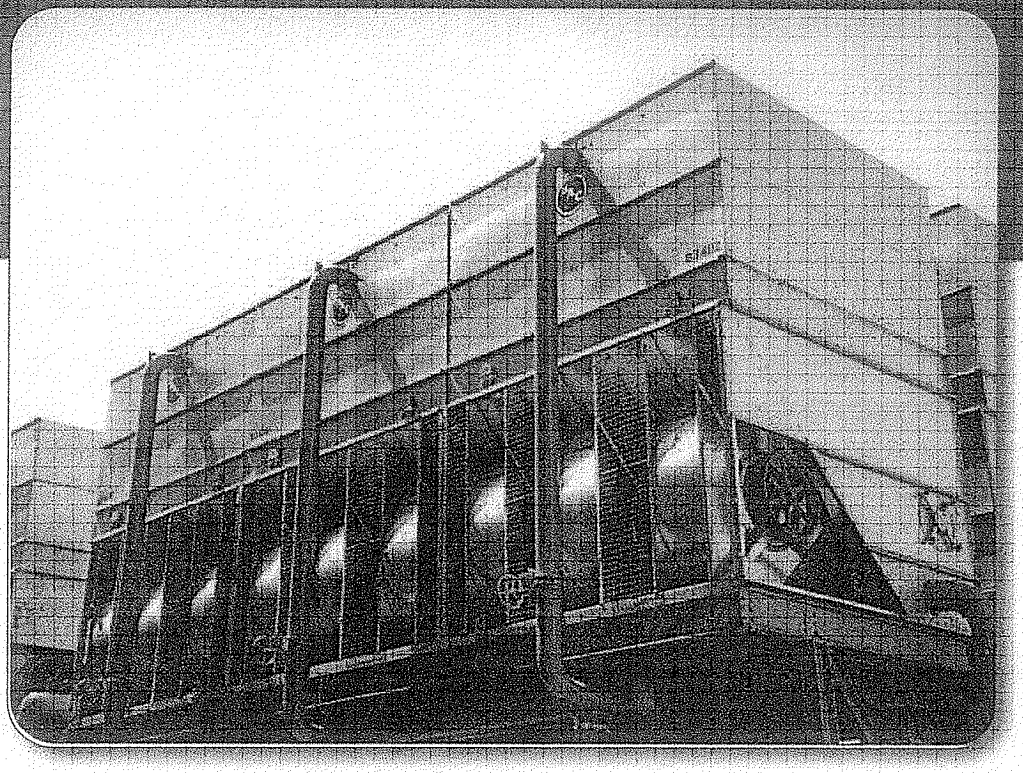
Engineering Data

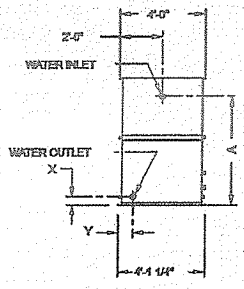
Series V Cooling Towers



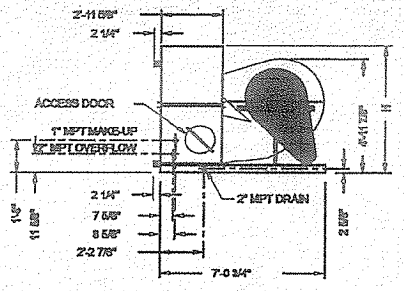
Engineering Data

VTL Engineering Data

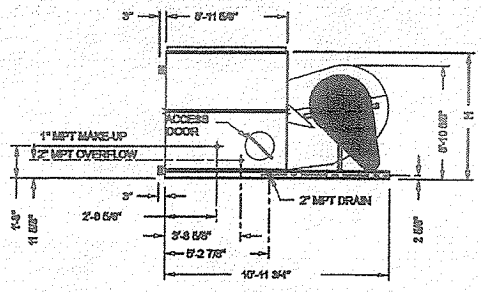
Series V Engineering Data



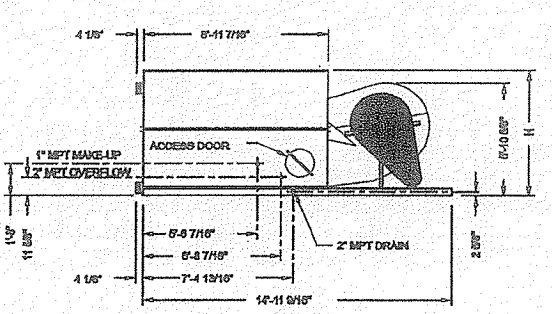
Models
VTL-016-E TO 137-M



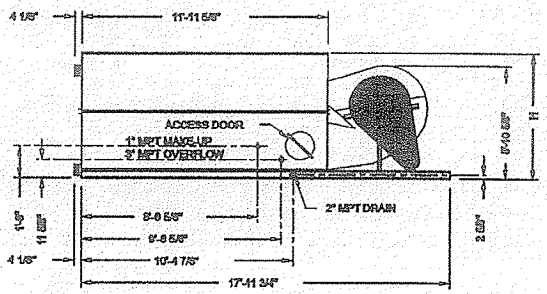
Models
VTL-016-E TO 039-H



Models
VTL-045-H TO 079-K



Models
VTL-063-K TO 095-K



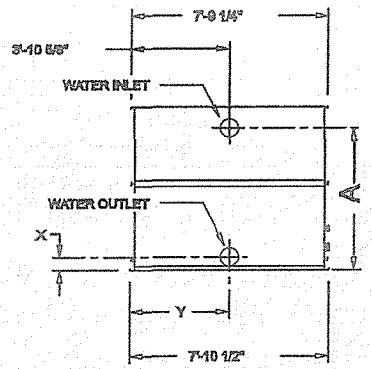
Models
VTL-103-K TO 137-M

Model Number	Nominal Tonnage	Motor HP	Airflow (CFM)	Weights (lbs)		Dimensions				Connections		
				Operating	Shipping	A	H	X	Y	Inlet	Outlet	Overflow
VTL-016-E	16	1.5	7,680	1,620	1,100	4' 0-3/4"	5' 1-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-021-F	21	2	8,150	1,660	1,140	4' 0-3/4"	5' 1-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-027-F	27	2	7,370	1,740	1,220	5' 7"	6' 6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-030-G	30	3	8,270	1,770	1,250	5' 7"	6' 6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-034-H	34	5	9,420	1,810	1,290	5' 7"	6' 6-1/4"	4-9/16"	7-3/4"	3"	3"	2"
VTL-039-H	39	5	8,860	1,910	1,390	7' 1-5/16"	8' 1-13/16"	4-9/16"	7-3/4"	3"	3"	2"
VTL-045-H	45	5	16,910	2,710	1,650	4' 0-3/4"	5' 1-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-051-G	51	3	13,350	2,810	1,750	5' 7"	6' 6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-059-H	59	5	15,490	2,830	1,770	5' 7"	6' 6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-066-J	66	7.5	17,210	2,900	1,840	5' 7"	6' 6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-072-K	72	10	18,690	2,930	1,870	5' 7"	6' 6-1/4"	4-1/16"	7-3/4"	4"	4"	2"
VTL-079-K	79	10	17,500	3,100	2,040	7' 1-5/16"	8' 1-13/16"	4-1/16"	7-3/4"	4"	4"	2"
VTL-082-K	82	10	22,400	3,810	2,260	5' 7"	6' 6-1/4"	5-1/8"	8-13/16"	6"	6"	2"
VTL-092-L	92	15	24,980	3,940	2,390	5' 7"	6' 6-1/4"	5-1/8"	8-13/16"	6"	6"	2"
VTL-095-K	95	10	21,150	4,070	2,510	7' 1-5/16"	8' 1-11/16"	5-1/8"	8-13/16"	6"	6"	2"
VTL-103-K	103	10	24,990	4,740	2,680	5' 7"	6' 6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-116-L	116	15	28,200	4,800	2,740	5' 7"	6' 6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-126-M	126	20	30,700	4,810	2,750	5' 7"	6' 6-1/4"	5-1/8"	8-13/16"	6"	6"	3"
VTL-137-M	137	20	29,560	5,120	3,060	7' 1-5/16"	8' 1-13/16"	5-1/8"	8-13/16"	6"	6"	3"

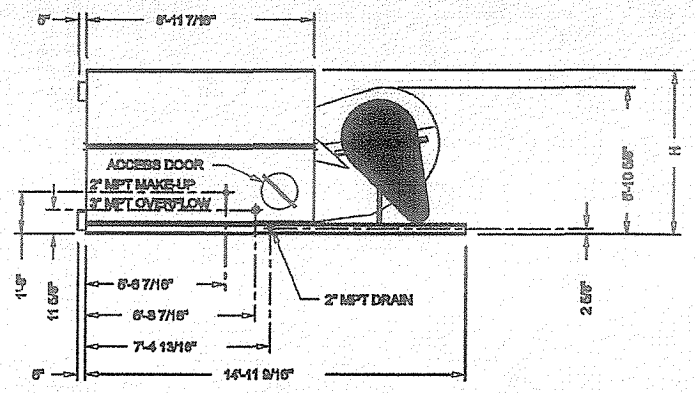
Do not use for construction. Refer to factory certified dimensions.

VTL Engineering Data

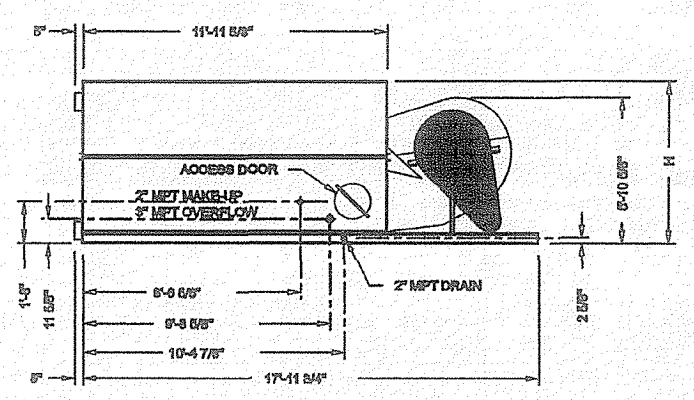
Series V Engineering Data



Models
VTL-152-M TO 272-P



Models
VTL-152-M TO 227-O



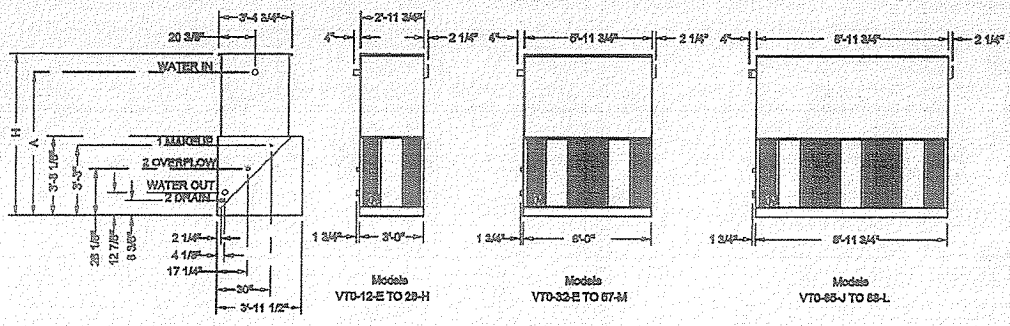
Models
VTL-245-P TO 272-P

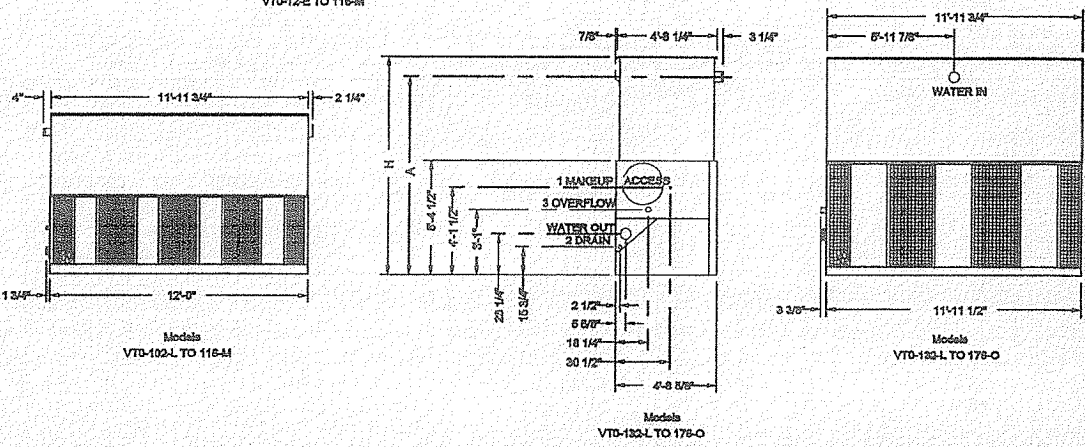
Model Number	Nominal Tonnage[4]	Motor HP[3]	Airflow (CFM)	Weights (lbs)		Dimensions				Connections[2]		
				Operating[1]	Shipping	A	H	X	Y	Inlet	Outlet	Overflow
VTL-152-M	152	20	45,870	6,580	3,440	4' 1-3/4"	5' 1-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-171-L	171	15	39,940	6,820	3,680	5' 8"	6' 6-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-185-M	185	20	43,150	6,960	3,820	5' 8"	6' 6-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-198-N	198	25	46,090	7,000	3,860	5' 8"	6' 6-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-209-O	209	30	48,630	7,040	3,900	5' 8"	6' 6-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-227-O	227	30	46,550	7,470	4,300	7' 2-5/16"	8' 1-13/16"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-245-P	245	40	58,820	8,970	4,790	5' 8"	6' 6-1/4"	6-1/8"	3' 11-1/4"	8"	8"	3"
VTL-272-P	272	40	56,760	9,490	5,310	7' 2-5/16"'	8' 1-3/16"	6-1/8"	3' 11-1/4"	8"	8"	3"

Notes:

1. Operating weight is for the tower with the water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Nominal tons of cooling represents 3 GPM of water cooled from 95ºF to 85ºF at a 78ºF entering wet-bulb temperature.

VT0 Engineering Data

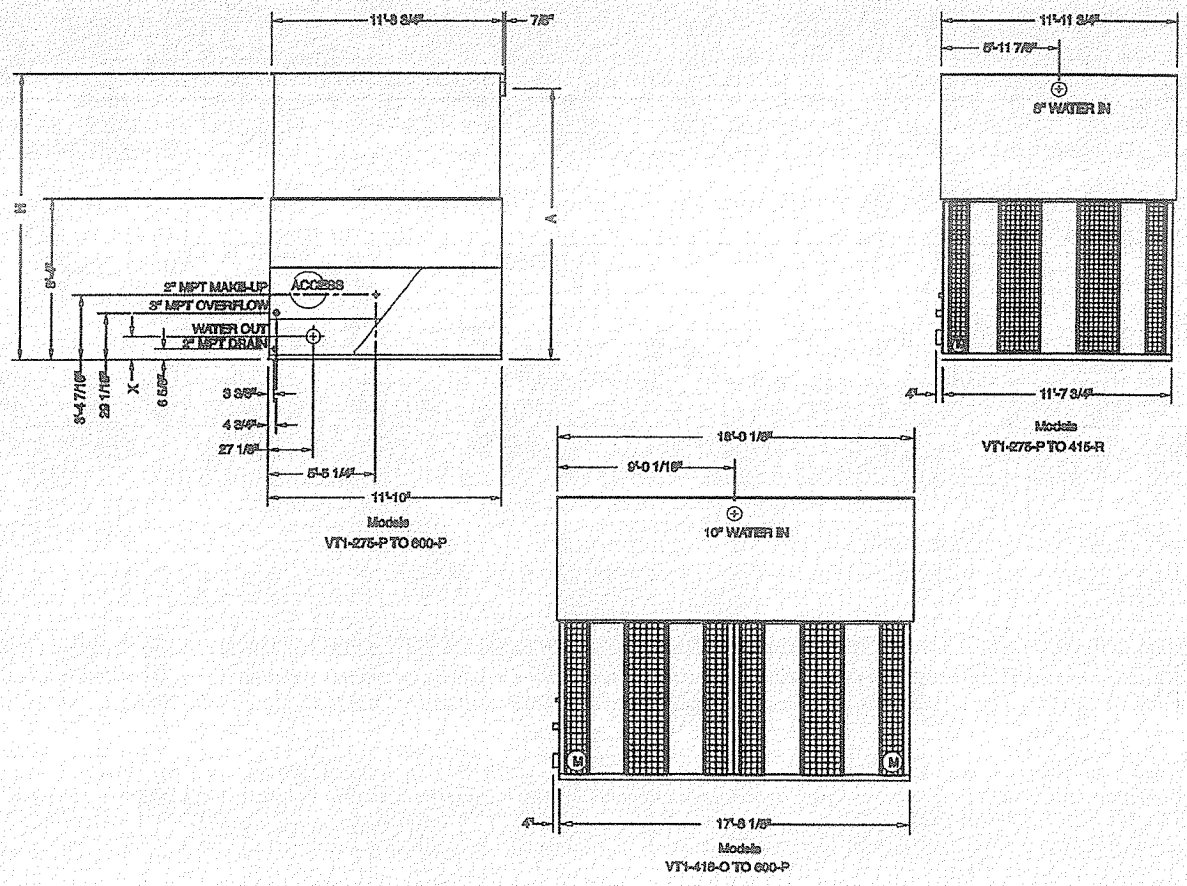




Model Number	Nominal Tonnage[1]	Motor HP[2]	Airflow (CFM)	Weight: (lbs) Operating	Weight: (lbs) Shipping	Dimensions A	Dimensions H	Dimensions B	Connections Inlet	Connections Outlet	Connections Overflow
VT0-12-E	12	1.5	4,970	960	790	6' 7-7/8"	7' 6-1/8"	12-7/8"	3"	3"	2"
VT0-14-F	14	2	5,460	970	800	6' 7-7/8"	7' 6-1/8"	12-7/8"	3"	3"	2"
VT0-19-G	19	3	6,190	990	820	6' 7-7/8"	7' 6-1/8"	12-7/8"	3"	3"	2"
VT0-24-G	24	3	5,945	1,050	950	8' 1-7/8"	9' 0-1/8"	12-7/8"	3"	3"	2"
VT0-28-H	28	5	6,960	1,170	970	8' 1-7/8"	9' 0-1/8"	12-7/8"	3"	3"	2"
VT0-32-H	32	5	11,820	1,590	1,230	6' 7-7/8"	7' 6-1/8"	12-7/8"	3"	3"	2"
VT0-41-J	41	7.5	13,435	1,650	1,290	6' 7-7/8"	7' 6-1/8"	12-7/8"	3"	3"	2"
VT0-52-J	52	7.5	12,960	1,780	1,540	8' 1-7/8"	9' 0-1/8"	12-7/8"	3"	3"	2"
VT0-57-K	57	10	14,180	1,790	1,550	8' 1-7/8"	9' 0-1/8"	12-7/8"	3"	3"	2"
VT0-65-J	65	7.5	16,860	2,580	2,000	8' 1-7/8"	9' 0-1/8"	12-7/8"	4"	4"	2"
VT0-75-K	75	10	18,435	2,590	2,010	8' 1-7/8"	9' 0-1/8"	12-7/8"	4"	4"	2"
VT0-78-K	78	10	17,990	2,710	2,130	9' 7-1/8"	10' 6-1/8"	12-7/8"	4"	4"	2"
VT0-88-L	88	15	20,420	2,770	2,190	9' 7-1/8"	10' 6-1/8"	12-7/8"	4"	4"	2"
VT0-102-L	102	15	25,060	3,310	2,500	8' 1-7/8"	9' 0-1/8"	12-7/8"	4"	4"	2"
VT0-107-L[3]	107	15	24,460	3,680	2,870	9' 7-1/8"	10' 6-1/8"	12-7/8"	4"	4"	2"
VT0-116-M[3]	116	20	26,670	3,740	2,930	9' 7-1/8"	10' 6-1/8"	12-7/8"	4"	4"	2"
VT0-132-L	132	15	30,600	5,190	3,820	10' 9-7/8"	11' 9-1/8"	23-1/4"	6"	6"	3"
VT0-145-M	145	20	33,670	5,200	3,830	10' 9-7/8"	11' 9-1/8"	23-1/4"	6"	6"	3"
VT0-155-N	155	25	36,240	5,250	3,880	10' 9-7/8"	11' 9-1/8"	23-1/4"	6"	6"	3"
VT0-166-N[3]	166	25	35,265	5,650	4,280	12' 3-7/8"	13' 3-1/8"	23-1/4"	6"	6"	3"
VT0-176-O[3]	176	30	37,330	5,680	4,310	12' 3-7/8"	13' 3-1/8"	23-1/4"	6"	6"	3"

Do not use for construction. Refer to factory certified dimensions.

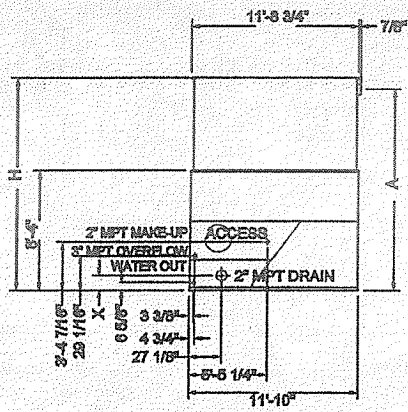
VT1 Engineering Data



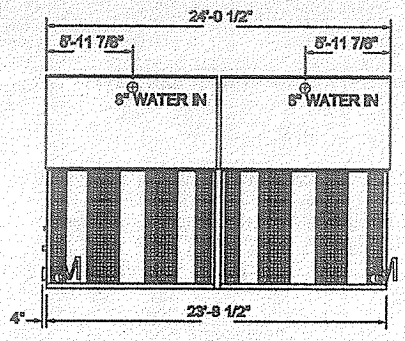
Model Number	Nominal Tonnage[1]	Motor HP[2]	Airflow (CFM)	Weights (lbs)			Dimensions			Connections		
				Operating[3]	Shipping	Heaviest Section	A	B	X	Inlet	Outlet	Make-up
VT1-275-P	275	40	82,350	15,190	8,040	5,140	12' 2-7/8"	12' 10-5/8"	14-1/2"	8"	8"	2"
VT1-307-O	307	30	74,350	15,780	8,630	4,950	13' 11-7/8"	14' 9-3/8"	14-1/2"	8"	8"	2"
VT1-340-P	340	40	81,550	15,970	8,820	5,140	13' 11-7/8"	14' 9-3/8"	14-1/2"	8"	8"	2"
VT1-375-P	375	40	79,300	16,940	9,790	5,140	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-400-Q	400	50	85,150	16,980	9,830	5,180	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-415-R	415	60	90,250	17,100	9,950	5,300	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-416-O	416	(2) 30	125,046	22,430	11,530	7,280	12' 1-7/8"	12' 10-5/8"	13-1/2"	10"	10"	2"
VT1-478-N	478	(2) 25	116,150	23,600	12,700	7,240	13' 10-7/8"	14' 9-3/8"	13-1/2"	10"	10"	2"
VT1-507-O	507	(2) 30	123,150	23,640	12,740	7,280	13' 10-7/8"	14' 9-3/8"	13-1/2"	10"	10"	2"
VT1-560-O	560	(2) 30	119,750	25,080	14,180	7,280	15' 3-5/8"	16' 2-1/8"	13-1/2"	10"	10"	2"
VT1-600-P	600	(2) 40	131,250	25,460	14,560	7,660	15' 3-5/8"	16' 2-1/8"	13-1/2"	10"	10"	2"

Do not use for construction. Refer to factory certified dimensions.

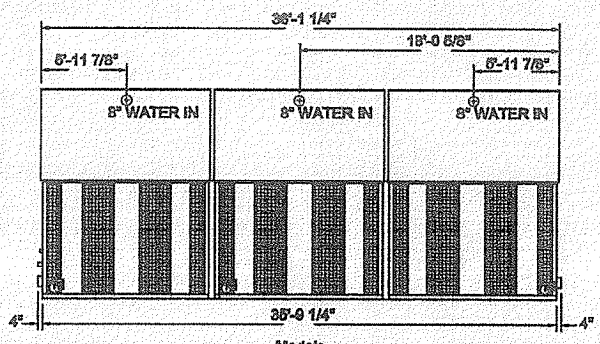
VT1 Engineering Data



Models
VT1-550-P TO 1355-P



Models
VT1-550-P TO 830-R



Models
VT1-825-P TO 1355-S

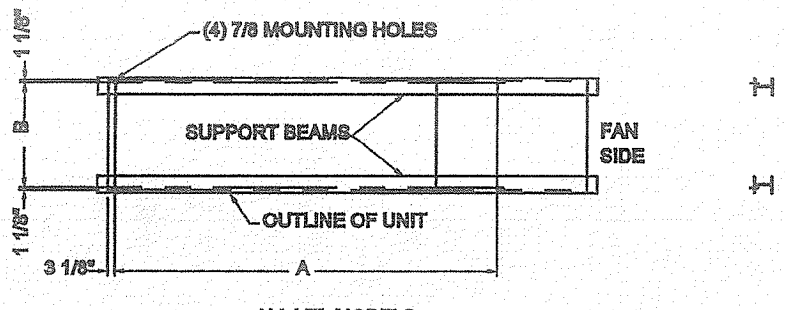
Model Number	Nominal Tonnage[1]	Motor HP	Airflow (CFM)	Weights (lbs)			Dimensions			Connections		
				Operating[1]	Shipping	Heaviest Section	A	H	X	Inlet	Outlet	Make-up
VT1-550-P	550	(2) 40	165,060	30,590	16,020	10,220	12' 2-7/8"	12' 10-5/8"	12-1/2"	(2) 8"	12"	2"
VT1-680-P	680	(2) 40	163,100	32,150	17,580	10,220	13' 11-7/8"	14' 9-3/8"	12-1/2"	(2) 8"	12"	2"
VT1-750-P	750	(2) 40	158,600	34,090	19,520	10,220	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-800-Q	800	(2) 50	170,300	34,170	19,600	10,300	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-830-R	830	(2) 60	180,500	34,410	19,840	10,540	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-825-P	825	(3) 40	247,590	45,980	24,000	15,300	12' 2-7/8"	12' 10-5/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-921-Q	921	(3) 30	223,050	47,750	25,770	14,730	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1020-P	1020	(3) 40	244,650	48,320	26,340	15,300	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1125-P	1125	(3) 40	237,900	51,230	29,250	15,300	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 6"	(2) 10"	3"
VT1-1200-Q	1200	(3) 50	255,450	51,350	29,370	15,420	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1245-R	1245	(3) 60	270,750	51,710	29,730	15,780	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1335-S	1335	(3) 75	290,550	51,770	29,790	15,840	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"

Notes:

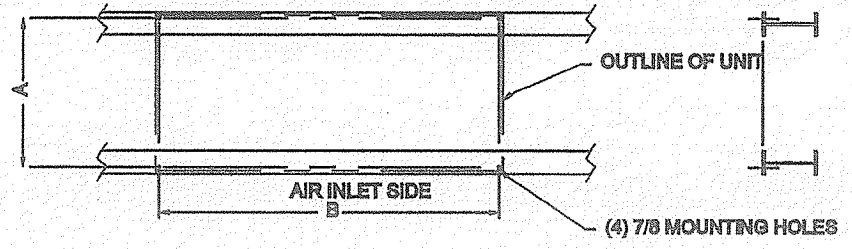
1. Operating weight is for tower with water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Fans on models VT1-416 through 600 must be cycled simultaneously for capacity control. For additional steps of control beyond on/off operation, a variable frequency drive, the BALTIGUARD™ Fan System, or two-speed motors are recommended.
5. Nominal tons of cooling represents 3 GPM of water cooled from 95°F to 85°F at a 78°F entering wet-bulb temperature.

Structural Support

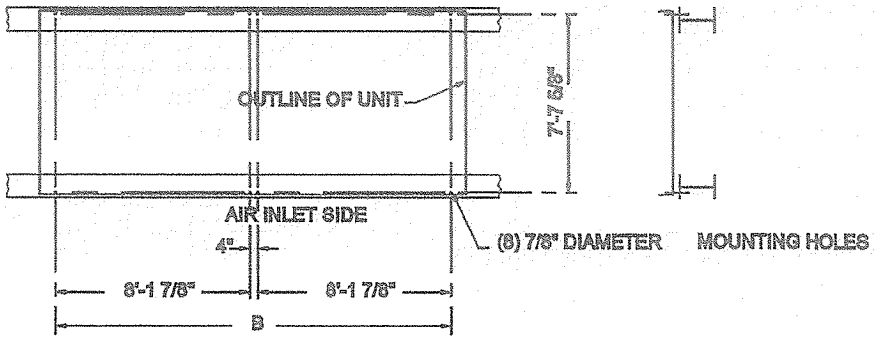
The recommended support arrangement for the Series V Cooling Tower consists of parallel I-beams running the full length of the unit, spaced as shown in the following drawing. Besides providing adequate support, the steel also serves to raise the unit above any solid foundation to ensure access to the bottom of the tower. To support a Series V Cooling Tower in an alternate steel support arrangement, consult your local BAC Representative.



ALL VTL MODELS

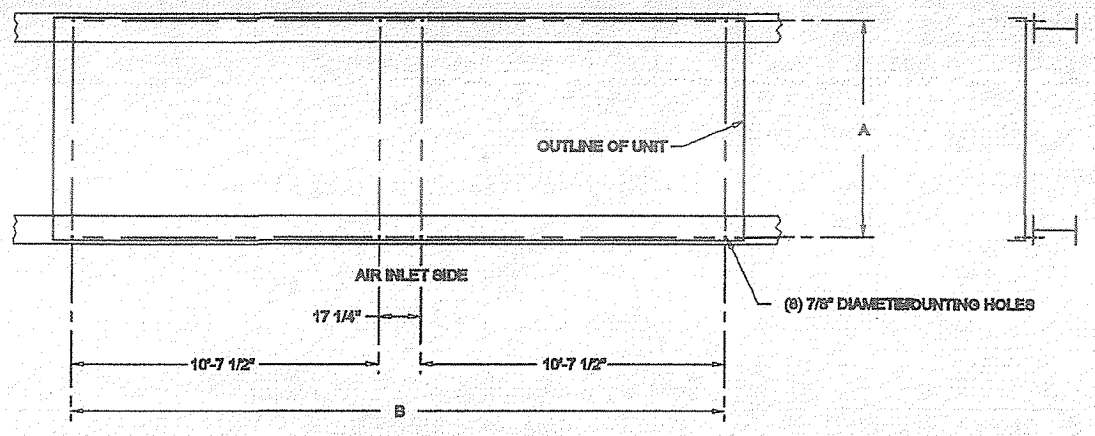


ALL VT0 MODELS & VT1-N209-P THRU N255-P & VT1-275-P THRU 415-R



ALL VT0 MODELS & VT1-N301-Q THRU N510-P & VT1-416-P THRU 630-R

Structural Support



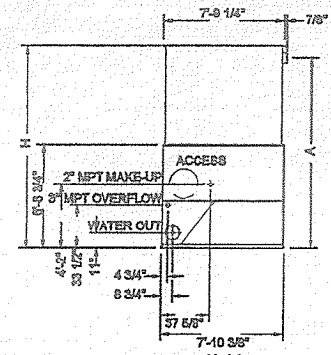
MODELS VT1-825-P THRU 1335-S

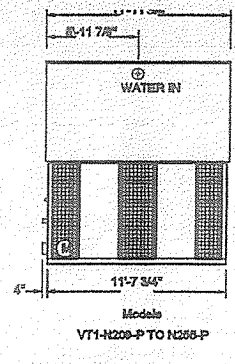
Model Number	A	B	Maximum Deflection
VTL-016-E thru 039-H	3' 11"	4' 6"	1/4"
VTL-045-H thru 079-K	3' 11"	7' 11-1/2"	3/8"
VTL-082-K thru 095-K	3' 11"	10' 11-1/4"	1/2"
VTL-103-K thru 137-M	3' 11"	13' 11-1/2"	1/2"
VTL-152-M thru 227-O	7' 8-1/4"	10' 11-1/4"	1/2"
VTL-245-P thru 272-P	7' 8-1/4"	13' 11-1/2"	1/2"
VTO-12-E thru 28-H	3' 9-3/8"	2' 5-1/2"	3/32"
VTO-32-H thru 57-K	3' 9-3/8"	5' 5-1/2"	3/16"
VTO-65-J thru 88-L	3' 9-3/8"	8' 5-1/4"	5/16"
VTO-102-L thru 116-M	3' 9-3/8"	11' 5-1/2"	3/8"
VTO-132-L thru 176-O	4' 6-1/4"	11' 5-1/2"	3/8"
VT1-N209-P thru N255-P	7' 7-5/8"	10' 7-1/2"	3/8"
VT1-N301-Q thru N395-R	7' 7-5/8"	16' 7-3/4"	1/2"
VT1-N418-P thru N510-P	7' 7-5/8"	22' 8-1/4"	1/2"
VT1-275-P thru 415-R	11' 7-1/4"	10' 7-1/2"	3/8"
VT1-416-O thru 600-P	11' 7-1/4"	16' 7-3/4"	1/2"
VT1-550-P thru 830-R	11' 7-1/4"	22' 8-1/4"	1/2"
VT1-825-P thru 1335-S	11' 7-1/4"	34' 9"	1/2"

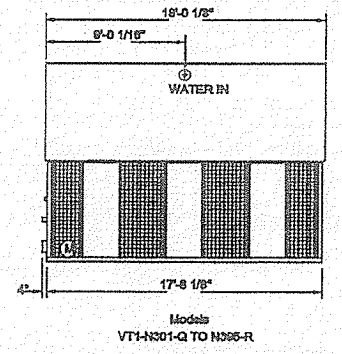
Notes:

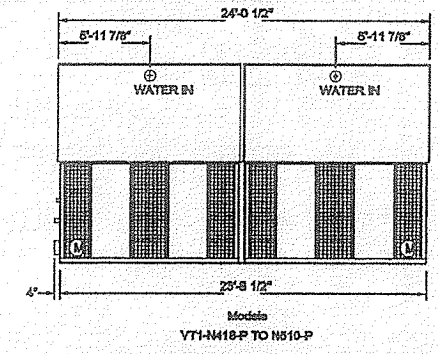
1. Support beams and anchor bolts are to be selected and installed by others.
2. All supporting steel must be level at the top.
3. Beams must be selected in accordance with accepted structural practice. The maximum allowable deflection of beams under unit shall be as specified in the table above.
4. When determining the length of steel beams, allow for the length of vibration isolation rails (by others), as they may be longer than the tower length shown above.
5. If point vibration isolation is used, the isolators must be located under the supporting steel, not between the support steel and the cooling tower.

VT1 Engineering Data









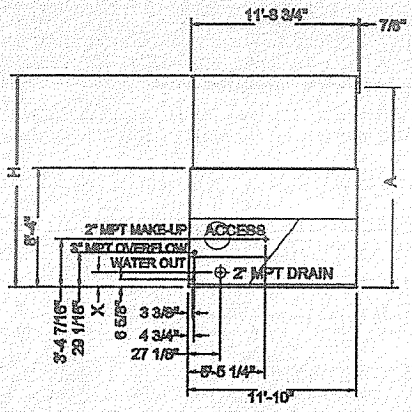
Model Number	Nominal Tonnage	Motor HP	Airflow (CFM)	Weights (lbs)			Dimensions			Connections	
				Operating	Shipping	Heaviest Section	A	H	B	Inlet	Outlet
VT1-N209-P	209	40	66,300	9,180	5,350	3,300	10' 7-5/8"	11' 5-1/8"	12"	8"	8"
VT1-N220-O	220	30	53,100	9,490	5,660	3,110	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N240-P	240	40	57,950	9,680	5,850	3,300	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N255-P	255	40	55,900	10,380	6,550	3,300	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N301-O	301	50	86,150	13,360	7,530	4,590	10' 7-5/8"	11' 3-3/8"	12"	8"	8"
VT1-N325-P	325	40	77,450	14,110	8,280	4,550	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N346-O	346	50	83,050	14,150	8,300	4,590	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N370-O	370	50	80,150	15,130	9,280	4,690	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N395-R	395	60	84,750	15,250	9,400	4,710	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N418-P	418	(2) 40	120,600	18,490	10,680	6,580	10' 7-5/8"	11' 3-3/8"	11"	(2) 8"	10"
VT1-N440-O	440	(2) 30	106,200	19,110	11,300	6,200	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N480-P	480	(2) 40	115,900	19,490	11,680	6,580	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N510-P	510	(2) 40	111,800	20,890	13,080	6,580	13' 9-3/8"	14' 6-7/8"	11"	(2) 8"	10"

Do not use for construction. Refer to factory certified dimensions.

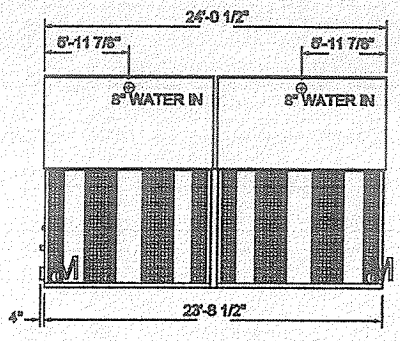
Notes:

1. Operating weight is for the tower with the water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Nominal tons of cooling represents 3 GPM of water cooled from 95°F to 85°F at a 78°F entering wet-bulb temperature.
5. Unit's casing section is the heaviest section.

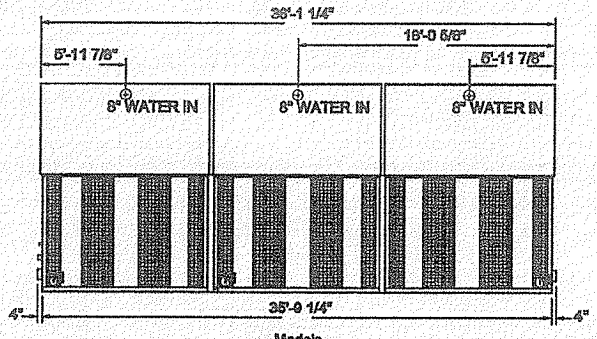
VT1 Engineering Data



Models
VT1-550-P TO 1355-P



Models
VT1-550-P TO 830-R



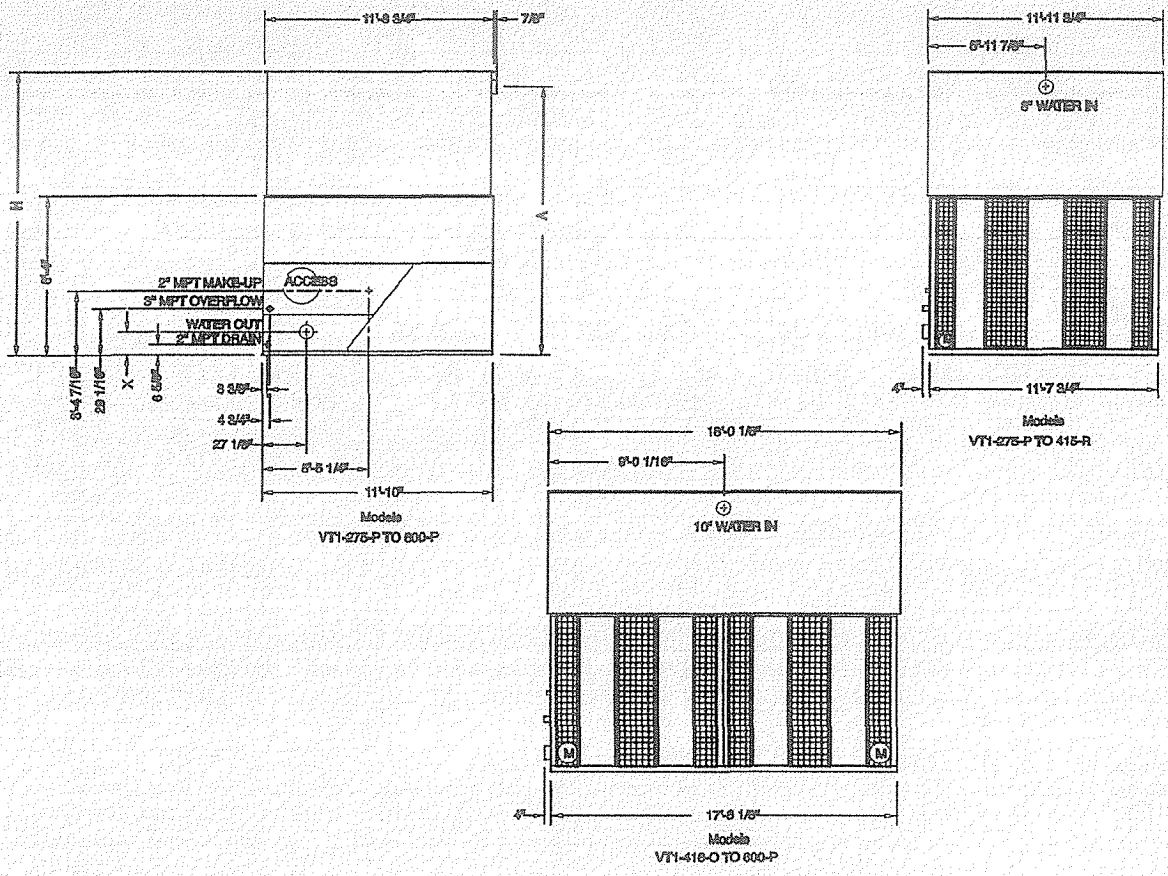
Models
VT1-825-P TO 1355-S

Model Number	Nominal Tonnage[5]	Motor HP[3]	Airflow (CFM)	Weights (lbs)			Dimensions			Connections		
				Operating[1]	Shipping	Nonwet Section	A	H	X	Inlet	Outlet	Make-up
VT1-550-P	550	(2) 40	165,060	30,590	16,020	10,220	12' 2-7/8"	12' 10-5/8"	12-1/2"	(2) 8"	12"	2"
VT1-680-P	680	(2) 40	163,100	32,150	17,580	10,220	13' 11-7/8"	14' 9-3/8"	12-1/2"	(2) 8"	12"	2"
VT1-750-P	750	(2) 40	158,600	34,090	19,520	10,220	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-800-Q	800	(2) 50	170,300	34,170	19,600	10,300	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-830-R	830	(2) 60	180,500	34,410	19,840	10,540	15' 4-5/8"	16' 2-1/8"	12-1/2"	(2) 8"	12"	2"
VT1-825-P	825	(3) 40	247,590	45,980	24,000	15,300	12' 2-7/8"	12' 10-5/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-921-Q	921	(3) 30	223,050	47,750	25,770	14,730	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1020-P	1020	(3) 40	244,650	48,320	26,340	15,300	13' 11-7/8"	14' 9-3/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1125-P	1125	(3) 40	237,900	51,230	29,250	15,300	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1200-Q	1200	(3) 50	255,450	51,350	29,370	15,420	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1245-R	1245	(3) 60	270,750	51,710	29,730	15,780	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"
VT1-1335-S	1335	(3) 75	290,550	51,770	29,790	15,840	15' 4-5/8"	16' 2-1/8"	13-1/2"	(3) 8"	(2) 10"	3"

Notes:

1. Operating weight is for tower with water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Fans on models VT1-416 through 600 must be cycled simultaneously for capacity control. For additional steps of control beyond on/off operation, a variable frequency drive, the BALTIGUARD™ Fan System, or two-speed motors are recommended.
5. Nominal tons of cooling represents 3 GPM of water cooled from 95°F to 85°F at a 78°F entering wet-bulb temperature.

VT1 Engineering Data

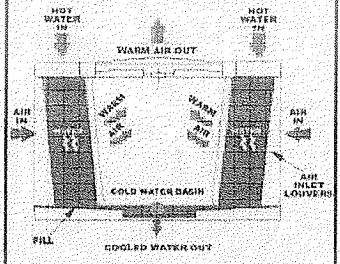
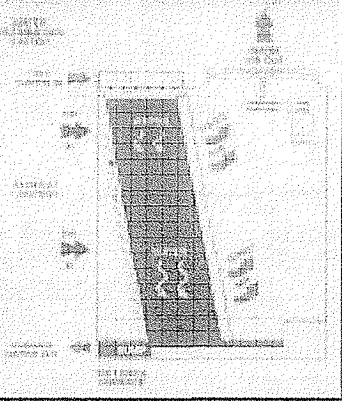
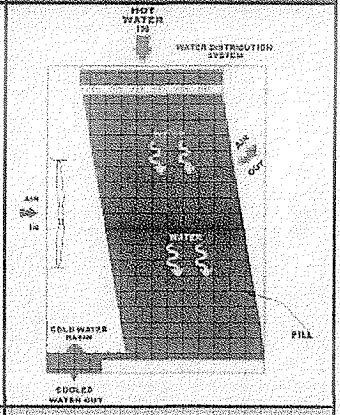


Model Number	Nominal Tonnage	Motor HP	Airflow (CFM)	Weights (lbs)			Dimensions			Connections		
				Operating	Shipping	Heaviest Section	A	H	X	Inlet	Outlet	Make-up
VT1-275-P	275	40	82,350	15,190	8,040	5,140	12' 2-7/8"	12' 10-5/8"	14-1/2"	8"	8"	2"
VT1-307-O	307	30	74,350	15,780	8,630	4,950	13' 11-7/8"	14' 9-3/8"	14-1/2"	8"	8"	2"
VT1-340-P	340	40	81,550	15,970	8,820	5,140	13' 11-7/8"	14' 9-3/8"	14-1/2"	8"	8"	2"
VT1-375-P	375	40	79,300	16,940	9,790	5,140	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-400-Q	400	50	85,150	16,980	9,830	5,180	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-415-R	415	60	90,250	17,100	9,950	5,300	15' 4-5/8"	16' 2-1/8"	14-1/2"	8"	8"	2"
VT1-416-O	416	(2) 30	125,046	22,430	11,530	7,280	12' 1-7/8"	12' 10-5/8"	13-1/2"	10"	10"	2"
VT1-478-N	478	(2) 25	116,150	23,600	12,700	7,240	13' 10-7/8"	14' 9-3/8"	13-1/2"	10"	10"	2"
VT1-507-O	507	(2) 30	123,150	23,640	12,740	7,280	13' 10-7/8"	14' 9-3/8"	13-1/2"	10"	10"	2"
VT1-560-O	560	(2) 30	119,750	25,080	14,180	7,280	15' 3-5/8"	16' 2-1/8"	13-1/2"	10"	10"	2"
VT1-600-P	600	(2) 40	131,250	25,460	14,560	7,660	15' 3-5/8"	16' 2-1/8"	13-1/2"	10"	10"	2"

Do not use for construction. Refer to factory certified dimensions.

Open Circuit Cooling Towers

Product Lines

	Series 3000	Series 1500	FXT
Principle of Operation			
Configuration	Crossflow	Crossflow	Crossflow
Water distribution	Gravity	Gravity	Gravity
Fan system	Axial fan, induced draft	Axial fan, induced draft	Axial fan, forced draft
Capacity range (Single cell)	220 - 1,350 Nominal Tons 660 - 4,050 GPM at 95°F/85°F/78°F	128 - 428 Nominal Tons 384 - 1,284 GPM at 95°F/85°F/78°F	6 - 268 Nominal Tons 18 - 804 GPM at 95°F/85°F/78°F
Maximum entering water temperature	130°F (54.4°C) Standard Fill; 140°F (60.0°C) with alternative fill material	120°F (48.9°C) Standard Fill; 135°F (57.2°C) with alternative fill material	125°F (51.7°C) Standard Fill; 140°F (60.0°F) with alternative fill material
Typical applications	Medium to large HVAC & industrial applications Replacement of field erected towers w/basinless units	Medium HVAC & industrial applications Counterflow unit replacements Crossflow unit replacements Tight enclosures & installations requiring a single air inlet	Small HVAC & industrial applications

Baltimore Aircoil Company

Cooling Towers

Cooling towers provide evaporative cooling for many types of systems. The specific application will largely determine which BAC Cooling Tower is best suited for a project.

Comparison Table (http://www.baltimoreaircoil.com/english/wp-content/uploads/2009/10/CT_Overview_Chart.pdf)

Specific application assistance is available through your **local BAC Representative (/english/representative-search)**.

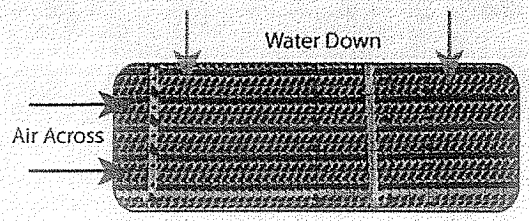
Principle of Operation

Cooling towers reject heat from water-cooled systems to the atmosphere. Hot water from the system enters the cooling tower and is distributed over the fill (heat transfer surface). Air is induced or forced through the fill, causing a small portion of the water to evaporate. This evaporation removes heat from the remaining water, which is collected in the cold water basin and returned to the system to absorb more heat. Each cooling tower line, although operating under the same basic principle of operation, is arranged a little differently.

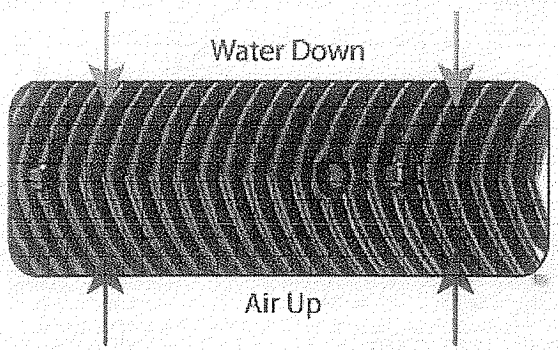
Comparison Table (http://www.baltimoreaircoil.com/english/wp-content/uploads/2009/10/CT_Overview_Chart.pdf)

Configuration

There are two main configurations of factory assembled cooling towers: crossflow and counterflow. In crossflow cooling towers, the water flows vertically down the fill as air flows horizontally across. In counterflow cooling towers, the water flows vertically down the fill as air flows vertically up.

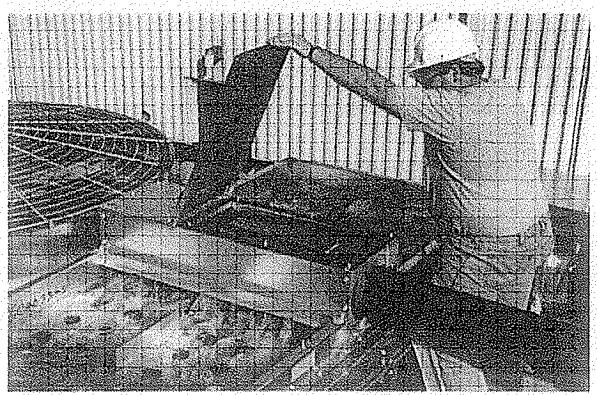


Crossflow Configuration



Counterflow Configuration

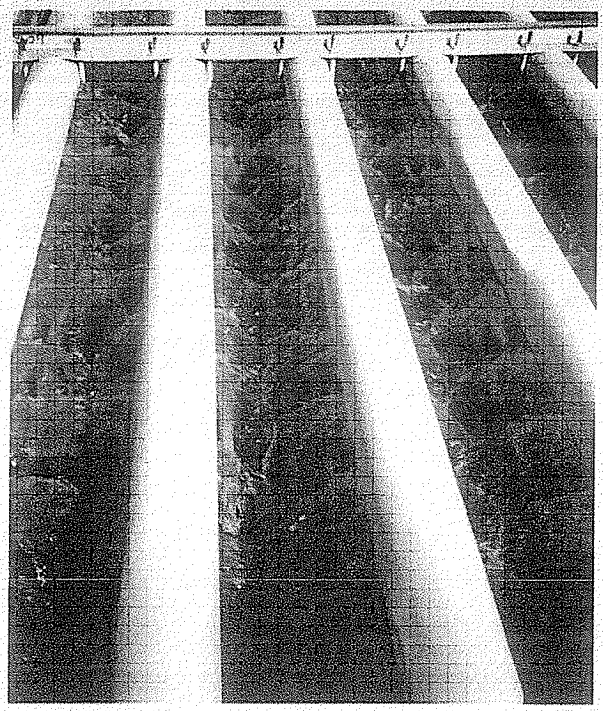
Water Distribution System



Gravity Distributuion Basin

Cooling towers employ either gravity distribution or pressurized spray systems to distribute water over the fill. Gravity systems, employed on BAC's crossflow cooling towers, feature hot water basins mounted on top of the tower above the fill. A series of spray nozzles in each hot water basin distribute the water evenly over the fill. Gravity distribution systems generally require minimal pump head, can be inspected while the unit is in operation and are easy to access for routine maintenance and service.

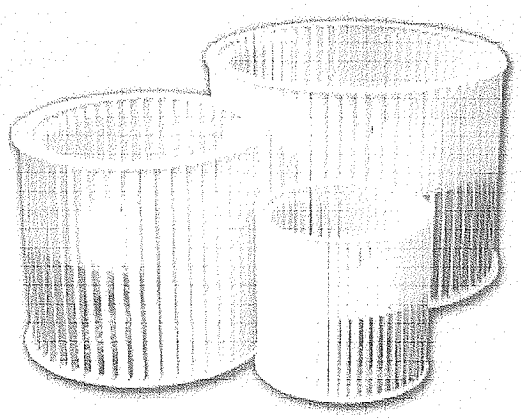
Spray distribution systems, employed on counterflow cooling towers, feature a series of PVC branches or pipes fitted with spray nozzles mounted inside the tower above the fill. These systems typically require 2 to 7 psi water pressure at the water inlet and require the unit to be out of service for inspection and maintenance.



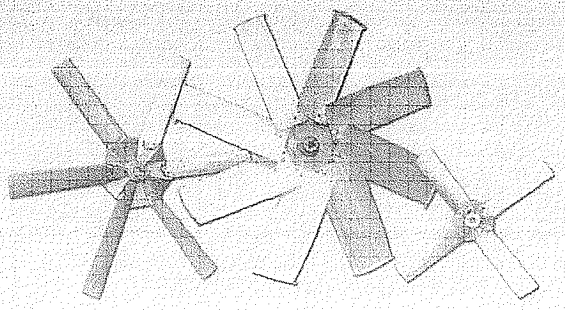
Spray Distribution

Fan System

The flow of air through most factory assembled cooling towers is provided by one or more mechanically driven fans. The fan(s) may be axial or centrifugal, each type having its own distinct advantages. Axial fan units require approximately half the fan motor horsepower of comparably sized centrifugal fan units, offering significant energy savings.



Centrifugal Fan



Axial Fan

Centrifugal fan units are capable of overcoming reasonable amounts of external static pressure (≤0.5" or 12.7mm of H_2O), making them suitable for both indoor and outdoor installations. Centrifugal fans are also inherently quieter than axial fans, although the difference is minimal and can often be overcome through the application of optional low sound fans and/or sound attenuation on axial fan units.

Induced Draft

The axial fans of induced draft equipment are mounted in the top deck of the unit, minimizing the impact of fan noise on nearby neighbors and providing maximum protection from fan icing with units operating in sub-freezing conditions. The use of corrosion resistant materials ensures long life and minimizes maintenance requirements for the air handling components.

Forced Draft

The fans are located on the air inlet face at the base of forced draft towers, facilitating easy access for routine maintenance and service. Additionally, the location of these components in the dry entering air stream extends component life by isolating them from the saturated discharge air.

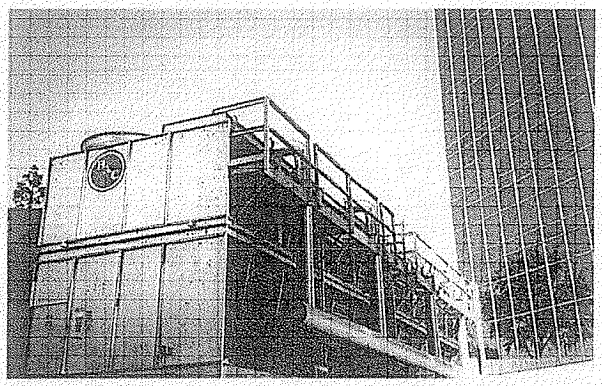
Capacity Range

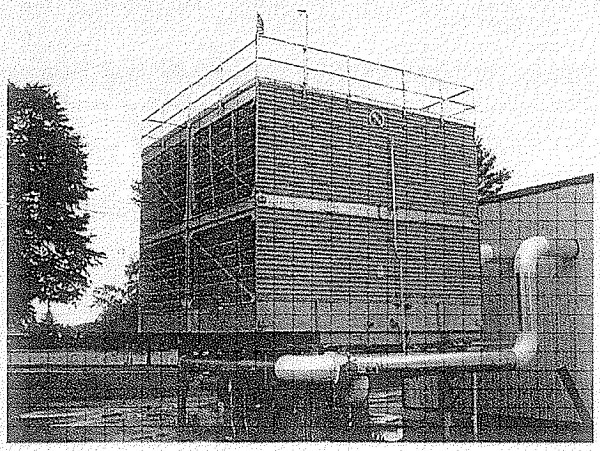
Product capacities are called out in terms of nominal tons. A nominal cooling tower ton is defined as the capability to cool 3 GPM (0.19 lps) of water from a 95°F (35.0°C) entering water temperature to an 85°F (29.4°C) leaving water temperature at a 78°F (25.6°C) entering wet-bulb temperature. Nominal conditions are typical of conventional HVAC designs in most parts of the country, but will not apply to all projects. BAC offers selection software (http://www.baltimoreaircoil.com/english/product-selection-software) to evaluate the performance of a tower at many conditions.

All capacities shown in the comparison table (http://www.baltimoreaircoil.com/english/wp-content/uploads/2009/10/CT_Overview_Chart.pdf) are for a single cell. Multiple cell selections can be applied to achieve larger capacities.

Maximum Entering Water Temperature

As previously stated, typical HVAC conditions call for an entering water temperature of approximately 95°F (35.0°C). All BAC Cooling Towers are capable of withstanding temperatures of at least 120°F (48.9°C) with standard fill materials. For applications where the entering water temperature exceeds 120°F (48.9°C) view the comparison table (http://www.baltimoreaircoil.com/english/wp-content/uploads/2009/10/CT_Overview_Chart.pdf) to determine whether alternate fill materials are required for your project.





Series V and Low Profile Series V Cooling Towers

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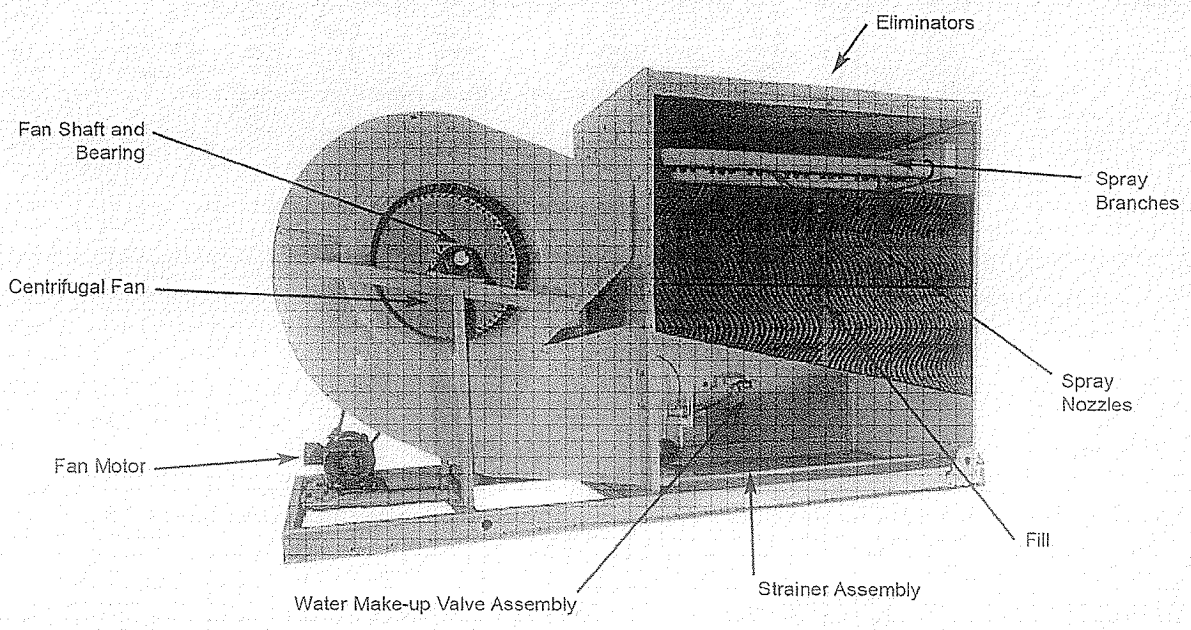


Figure 1 - VTL Low Profile Series V Cooling Tower

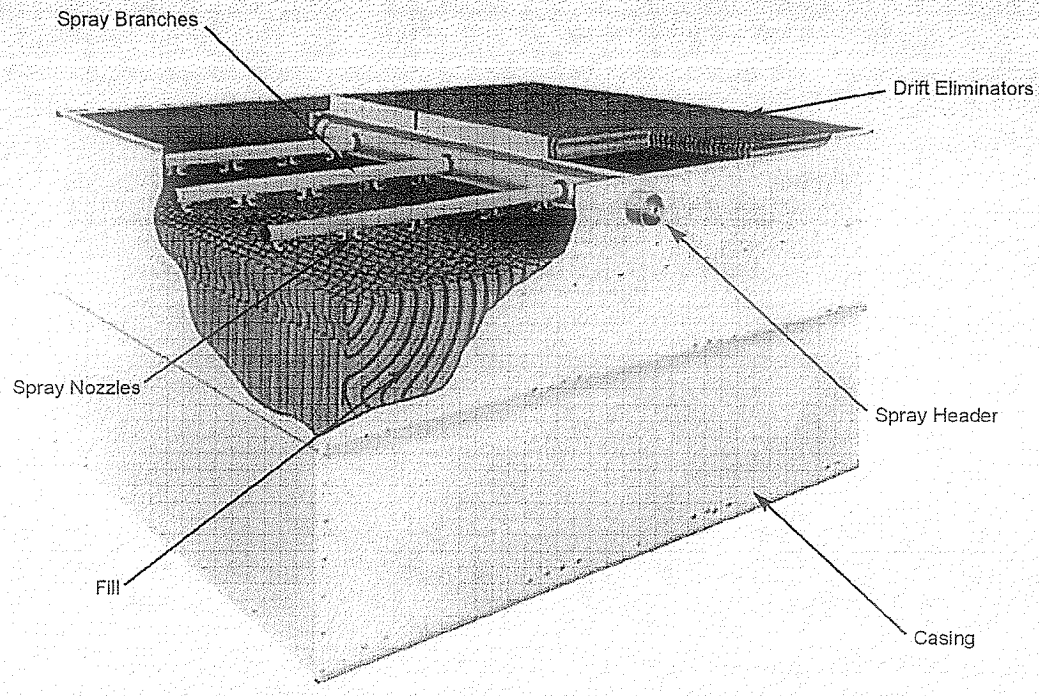


Figure 2a - Heat Transfer Casing Section for VT0 and VT1 Cooling Towers

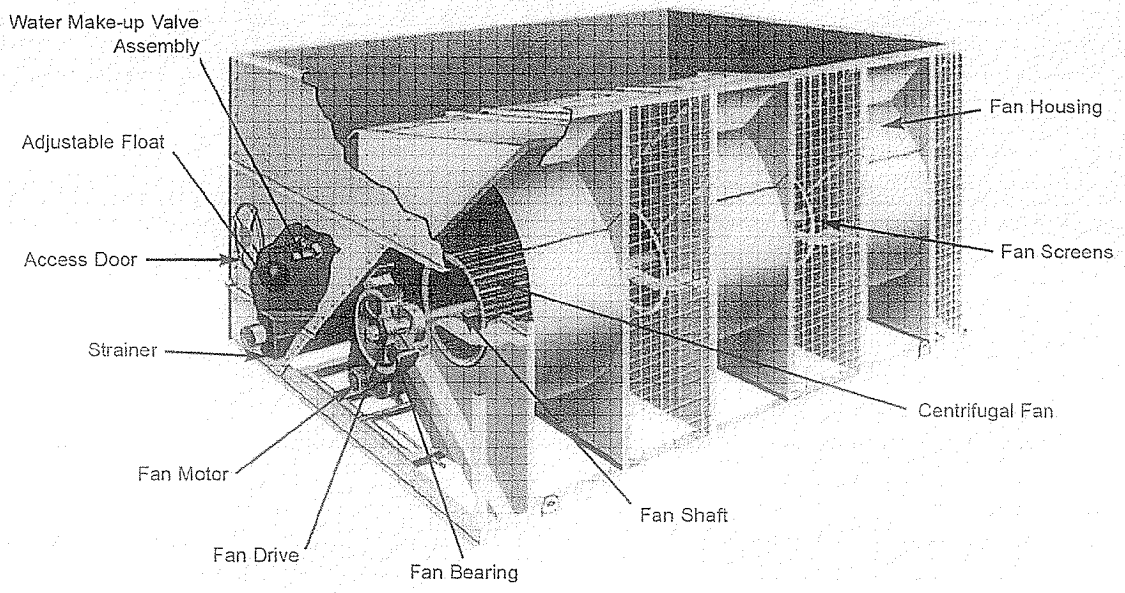


Figure 2b - Basin Section for VT0 and VT1 Cooling Towers

Table 1: Recommended Maintenance Services[1]

Type Service	Start-Up	Monthly	Quarterly	Annually	Shutdown
Inspect and clean as necessary:					
Inspect general condition of the unit[2] and check unit for unusual noise or vibration	X	X			
Clean and flush basin	X	X			X
Inspect spray nozzles	X	X			X
Clean basin strainer	X	X			X
Drain basin and piping					X
Check and adjust water level in basin	X	X			
Check operation of make-up valve	X	X			
Check and adjust bleed rate	X	X			
Inspect heat transfer section	X	X			
Inspect protective finish				X	
Mechanical equipment system:					
Check belt condition	X	X			
Adjust belt tension[3]	X		X		
Lubricate fan shaft bearings	X		X		X
Lubricate motor base adjusting nut	X		X		X
Check drive alignment				X	
Check motor voltage and current	X		X		
Check fan bearing locking collars	X		X		
Check fan motors for proper rotation	X				
Check fans for rotation without obstruction	X		X		

WARNING: Do not perform any service on or near the fans, motors, drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

NOTES:

1. Recommended service intervals are for typical installations. Different environmental conditions may dictate more frequent servicing.
2. When operating in ambient temperatures below freezing, the tower should be inspected more frequently. Refer to "Cold Weather Operation" on Page N102 for more details.
3. Tension on new belts must be readjusted after the first 24 hours of operation and quarterly, thereafter.

Operation and Maintenance

Initial and Seasonal Start-up

General

- If the unit is mounted on vibration isolators or isolation rails, refer to the vibration isolation manufacturer's guidelines before loading/unloading weight from the unit.
- Verify fan and system pump motors are disconnected and locked out.
- Conduct external inspection of the equipment. Check for leaks, corrosion, and any structural damage.
- Inspect piping and connections.

Cleaning

- Drain the cold water basin with the strainers in place.
- Remove all dirt and debris from the fan guards.
- Clean all mechanical components.
- Flush the cold water basin interior to remove any accumulated dirt and debris.
- Remove, clean, and replace the strainers.

Inspection

WARNING: Do not perform any service on or near the fans, motors, drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

- At seasonal start-up or after prolonged shutdown, check the motor insulation with an insulation tester prior to the motor start-up.
- Prior to the seasonal start-up, check and adjust the belt tension. At the initial start-up, the belt tension may not require adjustment as the drive will be properly tensioned at the factory prior to shipment.
- Start the fan motors and check for proper fan rotation.
- Run the fans in manual mode for several minutes to check for any unusual noise or vibrations.
- Check that the float operated make-up valve is operating freely.

WARNING: Check to ensure the controls for the fan motors are set to allow a maximum of 6 on-off cycles per hour.

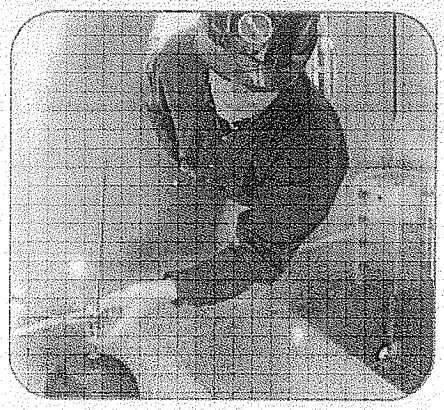


Figure 3 - Water Make-up Valve Assembly

Start-up

***WARNING:* Do not perform any service on or near the fans, motors, and drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.**

- Prior to seasonal start-up, lubricate the motor base adjusting screws (see Figure 6 on Page N55) and the fan shaft bearings. At initial start-up, no bearing lubrication is required since the bearings are factory lubricated prior to shipment.
- Fill the cold water basin with fresh water to the overflow level via the make-up valve.
  - o Water treatment for new installations: Initiate the biocide water treatment program at this time. Refer to "Biological Control" on Page N106 for more details.
  - o Water treatment for seasonal start-up or after a shutdown period in excess of 3 days: Resume the biocide treatment program and administer a shock treatment of appropriate biocides prior to operating the fans. This will eliminate accumulated biological contaminants. Refer to "Biological Control" on Page N106 for more details.
- Set the make-up valve float so the water shuts off at the overflow level.
- Start the system pump. See "Water Distribution System" on Page N56 for more details.
- Open the valve in the tower bleed line, and adjust the bleed by closing or opening the valve.
- Once the unit is operating, check the current and voltage of all three phases (legs) of the fan motors with a heat load on the tower under warm ambient conditions. The current must not exceed the nameplate ratings.
- Check the operation of the optional vibration cutout switch.

After 24 hours of operation under thermal load, perform the following services:

- Check the tower for any unusual noise or vibrations.
- Check the operating water level in the cold water basin.
- Adjust make-up valve if necessary.
- Check the belt tension and readjust if necessary.

Extended Shutdown

WARNING: Do not perform any service on or near the fans, motors, and drives, or inside the unit without first ensuring that the fans and the pumps are disconnected and locked out.

Perform the following services whenever the cooling tower is shutdown in excess of 3 days:

- If the unit is mounted on vibration isolators or isolation rails, refer to the manufacturer's guidelines before loading/unloading weight from the unit.

- Drain the cold water basin and all the piping that will be exposed to freezing temperatures. Heat trace and insulate all exposed piping.
- Clean all debris, such as leaves and dirt, from the interior and exterior of the unit.
- Clean and flush the cold water basin with the basin strainers in place.
- Leave the cold water basin drain open so rain and melting snow will drain from the tower.
- Clean the basin strainer and re-install.
- Lubricate the fan shaft bearings, motor base, and motor base adjusting screw.
- Close the shut off valve in the make-up water line (supplied by others), and drain all exposed make-up water piping. Heat trace and insulate all exposed piping.
- Inspect the protective finish on the unit. Clean and refinish as required. Refer to "Corrosion Protection" on Page N104 for more details.
- Secure the fan motors starting device in the "OFF" position to ensure personal safety in case of future inspection or service.

Detailed Component Maintenance Procedures

Cold Water Basin

As water circulating though the cooling tower is cooled, it collects in the cold water basin and passes through the suction strainer into the system. The cold water basin is constructed from one of the following materials of construction and the following maintenance applies to all basin materials of construction:

- Galvanized steel
- Thermosetting Hybrid Polymer
- Type 304 stainless steel

Water Levels

Table 2: Cold Water Basin Water Levels

Model Number	At Overflow Level (in.)	At Operating Level (in.)
VTL	10"	5-1/2"
VT0-12 to VT0-116	18-1/2"	13-3/8"
VT0-132 to VT0-176	21-1/2"	16-5/8"
VT1-N-xxx	31"	17"
VT1-xxx	24-1/2"	14"

- The make-up valve controls the operating level, which is maintained at the levels shown in Table 2.
- The operating water level in the cold water basin will vary with system thermal load (evaporation rate), the bleed rate employed, and the make-up water supply pressure.
- Check the operating water level monthly, and readjust the float when necessary to maintain the recommended operating level.

Inspection and Maintenance

WARNING: Openings and/or submerged obstructions may exist in the bottom of the cold water basin. Use caution when walking inside this equipment.

- Inspect the cold water basin regularly. Remove trash or debris accumulated in the basin or on the strainer.
- Quarterly, or more often if necessary, drain, clean, and flush the entire cold water basin with fresh water. This will remove the silt and sediment, which normally collects in the basin during operation. If not removed, sediment can become corrosive and cause deterioration of the protective finish of metallic basins.
- When flushing the basin, leave the strainers in place to prevent the sediment from re-entering the system.
- Remove the strainers after the basin has been flushed.
- Clean and replace the strainers before refilling the basin with fresh water.
- Adjust the float to maintain the design operating level. See Table 2: "Cold Water Basin Water Levels."

Fan

Series V and Low Profile Series V Cooling Towers use centrifugal fans. Thoroughly inspect the fans for damaged or deteriorated fan blades and replace the fan as required.

Inspection and Maintenance

- If the unit is already in operation, while the fans are still running, check for any unusual noise or vibration.
- With the fans off and the motor locked out and tagged, check the general condition of the fans:
  - Inspect for any loose or missing bolts in the locking collar and fan shaft bearings.
- **Rotation**: Turn the fan shift by hand to ensure that the fan moves freely with no rough spots, binding or other malfunctions that could cause vibration or fan motor overload.
- **Direction of Rotation:** On initial start-up, or if the fan motor has been rewired, bump the fan motor and note the direction of rotation.
- **Operation**: On initial start-up, run the fan in the manual position for several minutes and check for any unusual noises or vibration.

Fan Drive System

Inspection and Maintenance

- These drives require a periodic check of the belt condition and, when necessary, tension adjustment. The recommended service intervals are as follows:
  - **Initial Start-up**: Servicing is not required prior to initial tower start-up. The drive has been tensioned and aligned at the factory.
  - **Seasonal Start-up**: Readjust the belt tension.
  - **Operation**: After the first 24 hours of operation, readjust the belt tension on a new unit start-up or installation of a new belt. Thereafter, check the belt condition monthly, and adjust tension as necessary. Readjust tension at least once every 3 months.
- Belt tension check:
  - Place a straight edge along the belt from sheave to sheave as shown in Figure 4a, or use a tape measure as shown in Figure 4b, to measure belt deflection.
  - Apply a moderate force by hand (approximately 15 lbs/6.8 kg) evenly across the width of the belt in the center of the span between the sheaves.
  - There is adequate belt tension if the belt deflects between 1/4" and 3/8" as shown in Figures 4a and 4b.

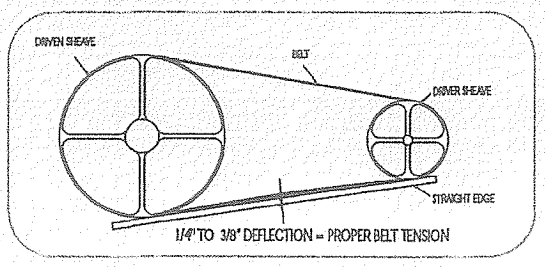


Figure 4a

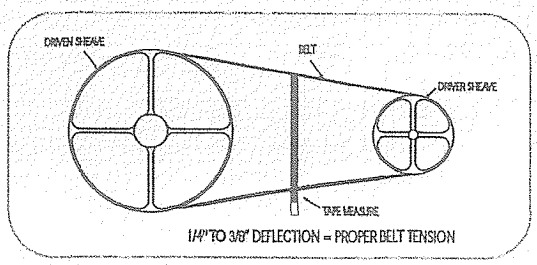


Figure 4b

Belt Tension

- Belt tension adjustment (if required):
  - Loosen the lock nut on the motor base adjusting screw.
  - Turn the motor base adjusting screw clockwise to tension the belt, or counterclockwise to relieve belt tension. During adjustment of belt tension, rotate the drives several times by hand to evenly distribute the tension throughout the belt.
- When the belt is properly tensioned, retighten the lock nut on the motor base adjusting screw.

NOTE: There should be no "chirp" or "squeal" when the fan motor is started.

Alignment:

- Check the drive alignment annually to ensure maximum belt life.
- Drive alignment check and adjustment:
  - Place a straight edge across the driver and the driven sheaves as shown in Figure 5.
  - The straight edge should contact all four points as shown in Figure 5 indicating proper drive alignment.
  - There should be no more than 1/16" deviation from four points of contact.
  - In case of realignment, loosen the motor sheave and align it with the fan sheave. Allow 1/4" for draw-up as the bushing screw is retightened.

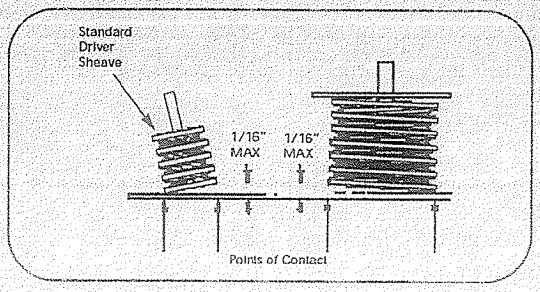


Figure 5 - Standard Drive Alignment

Fan Motors

Series V Cooling Towers and Low Profile Cooling Towers use cooling tower duty, premium efficient, totally enclosed, single-speed, single-winding, reversible ball bearing type motor(s).

Inspection and Maintenance

- Clean the outside of the motor at least quarterly to ensure proper motor cooling.
- After prolonged shutdowns, check the motor insulation with an insulation tester prior to restarting the motor.

Adjustable Motor Base

Coat the motor base slides and adjusting screws (see Figure 6) every 3 months using good quality corrosion inhibiting grease such as one recommended for lubricating the fan shaft bearings.

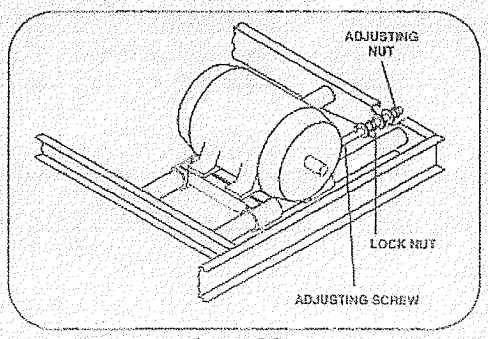


Figure 6 - Adjustable Motor Base

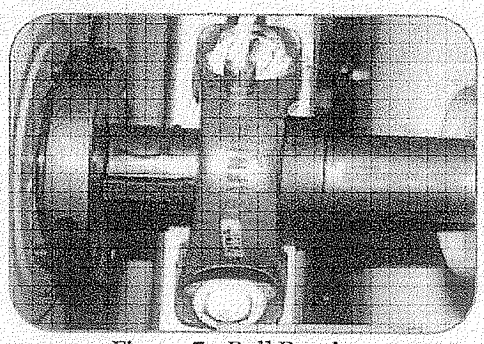


Figure 7 - Ball Bearing

Fan Shaft Bearings

The fan shafts are supported by ball bearings (see Figure 7). Each bearing is equipped with a lubrication fitting and locking collar.

Ball Bearings

Under normal operating conditions, the bearings should be greased every 2,000 operating hours or at least quarterly. The bearings should also be greased at seasonal start-up and shutdown. **Only lubricate the bearings with one of the following water resistant inhibited greases which are good for ambient temperatures ranging from -65°F (-53.9°C) to 250°F (121.1°C):**

Amoco - Rycon Premium #3	Exxon - Polyrex® EM	Shell - Alvania #3
Chevron - SRI	Exxon - Unirex N™	Shell - Dolium "R"
Citgo - Polyurea MP2™	MobilGrease® - AW2	SKF - LGHP2™
Conoco - Polyurea 2™	Shell - Alvania RL3™	Unocal 76 - Unilife Grease™

Only lubricate the bearings with a hand grease gun. Do not use high pressure grease guns since they may rupture the bearing seals. When lubricating, purge the old grease from the bearing by gradually adding grease until a bead of new grease appears at the seal.

Sleeve Bearings

Prior to start-up and during the first week of operation, the bearing oil cup (see Figure 8) must be refilled with an industrial-type mineral oil (see Table 3) to saturate the felt wick in the bearing reservoir. After the initial start-up, fill the bearing oil cup every 1,000 operating hours or at least every six months. When ambient temperatures below 0°F are expected, a light oil must be used. With such light oils, the bearing oil cup should be checked and refilled several times during the first several hours of operation until the bearings reach operating temperature.

Table 3: Sleeve Bearing Lubricants

Temp Ambient	BAC P/N	Texaco	EXXON
70°F to 100°F 30°F to 70°F	582628PI	Regal R & O 320 Regal R & O 150	Teresstic 220 Teresstic 100
5°F to 30°F -25°F to 5°F	582627PI	Regal R & O 32 Capella 32	Teresstic 32

Caution: Do not use oils containing detergents for bearing lubrication. Detergent oils will remove the graphite in the bearing sleeve and cause bearing failure. Also, do not disturb bearing alignment by tightening the bearing cap adjustment on a new unit as it is torque-adjusted at the factory.

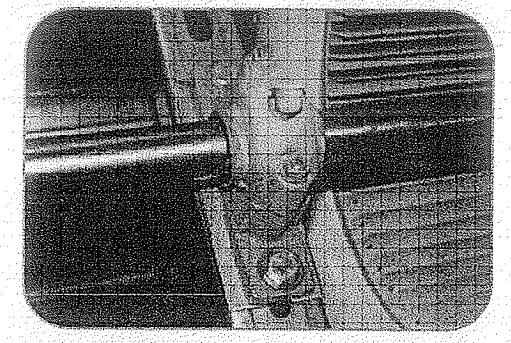


Figure 8 - Sleeve Bearing

Locking Collars

Each eccentric locking collar should be checked quarterly to ensure that the inner bearing race is secured to the fan shaft. The locking collar can be set using the following procedure (see Figure 9):

- Loosen the set screw.
- Using a drift pin or center punch, tap the collar (in the hole provided) tangentially in the direction of rotation while holding the shaft.
- Retighten the set screw.

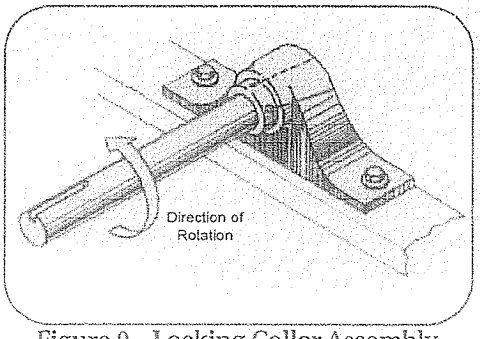


Figure 9 - Locking Collar Assembly

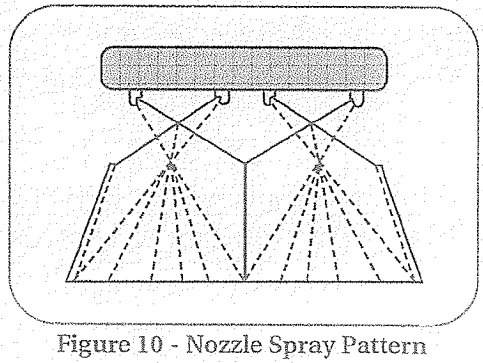


Figure 10 - Nozzle Spray Pattern

Water Distribution System

The hot water is distributed through a corrosion resistant polyvinyl chloride (PVC) spray distribution system. The drift eliminators are also made of PVC, which require no protection against rot, decay, rust, or biological attack.

The spray nozzles and heat transfer section should be inspected and cleaned each month. The inspection procedure is as follows:

- Shut off the fan, lock out and tag out the fan motor, but leave the system pump running.
- Remove the drift eliminators to allow a clear view of the spray distribution system and nozzle patterns.
- Check to see if the nozzles are all spraying consistently and producing the spray pattern in Figure 10.

- Quarterly or more often as required, turn off the system pump. Flush any dirt or debris from the water distribution system to prevent clogged nozzles. If necessary, remove the nozzle and the grommet for cleaning. To remove, grasp the nozzle and pull while twisting. Replace any damaged nozzles.
- Inspect the fill surface for bent edges or scale build-up.

Caution: Don't use steam or high pressure water to clean PVC eliminators or materials other than steel.

Water Level Control

There are two types of water level controls used on BAC units:

- Mechanical make-up valve assembly
- Optional electric water level control package

The Series V water make-up valve assembly is located within easy reach from the access door at the connection end of the unit.

Mechanical Make-up Valve Assembly

A float-operated mechanical water make-up assembly is furnished as standard equipment on the unit. The standard make-up assembly consists of a corrosion resistant make-up valve connected to a float arm assembly actuated by a polystyrene-filled plastic float. The float is mounted on an all-thread rod held in place by wing nuts. The cold water basin operating water level can be adjusted by repositioning the float and all-thread rod using the wing nuts provided.

NOTE: If the unit has been ordered with the optional electric water level control package or is intended for remote sump application, a mechanical water make-up valve will not be provided.

Inspection and Maintenance:

- Inspect the make-up valve assembly monthly and adjust if necessary.
- Inspect the valve annually for leakage. Replace the valve seat if necessary.
- Maintain the make-up water supply pressure between 15 psig and 50 psig for proper operation. BAC recommends a surge protector (provided by others) for pressures over 50 psig.
- Set the initial basin water level by adjusting the wing nuts, so that the make-up valve is completely closed when the water level in the cold water basin is at the overflow connection.
- With the design thermal load and the average water pressure (15 to 50 psig) at the valve, the above setting will produce operating water levels as stated in Table 2 on Page N53.
- If the thermal load is less than the design load at the time of unit start-up, the procedure may produce operating levels greater than those shown in Table 2. If operating levels are higher than specified, readjust the float in order to attain the recommended operating level.
- Closely monitor the water level in the cold water basin and adjust the level if necessary during the first 24 hours of operation.
- Operating at the recommended water level will ensure that the unit basin contains sufficient water volume to prevent air entrainment in the circulating pump during system start-up and provides sufficient excess basin capacity to accept the total system pull-down volume.

Optional Electric Water Level Control Package

As an option, an electric water level control package is available in lieu of the mechanical make-up assembly. The package consists of a probe-type liquid level control assembly and a slow-closing solenoid valve. Stainless steel electrodes, factory-set at predetermined lengths, extend from an electrode holder into the cold water basin.

Inspection and Maintenance:

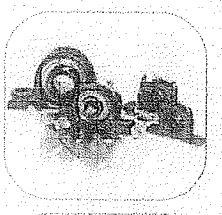
- Clean the stainless steel electrodes periodically to prevent accumulations of scale, corrosion, sludge or biological growth, which could interfere with the electrical circuit.
- The water level is maintained at the recommended operating level regardless of the system thermal load. Therefore, it is not recommended that the operating level be adjusted.
- During the start-up of units equipped with the electric water level control package, by-pass the control unit in order to fill the unit to the overflow connection.

Recommended Spare Parts

BAC parts are the "Perfect Fit" for your cooling tower. These parts are specifically designed, engineered and manufactured to work in a cooling tower environment. They are the right parts, at competitive pricing levels, and BAC offers the best deliveries in the industry.

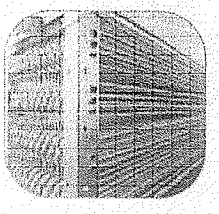
BAC stocks most common repair and retrofit parts in our Parts Depot℠ and can ship other parts, often overnight, from any of our three manufacturing facilities strategically located in California, Delaware, and Illinois. In addition, most BAC Representatives maintain a local inventory of commonly used parts.

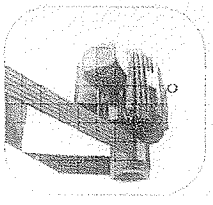
Even with this fast delivery capability, it is still recommended that certain essential, emergency repair parts be maintained in your local inventory, to minimize any potential downtime.



Basic Recommended Spare Parts

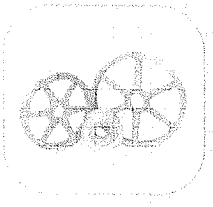
Bearing set
Float valve or repair kit
Float ball
Solenoid valve (if unit is equipped with electric water level control)
Powerband or set of belts
Spray nozzle kit with grommets
Basin heater and low water cut out
Door gasket
Strainer (inlet and suction)
Fan and sheave bushings
Pump seal and gasket kit for coil products
Automatic bearing greaser refill kit





Parts to Consider if Extended Downtime is a Concern

Spray pump for coil products
Fan or fan wheel
Fan shaft
Sheave set
Fan motor



Common Operation & Maintenance Section

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Variable Frequency Drive Operation

- Applications utilizing variable frequency drives (VFDs) for fan motor control must use inverter duty motors built in compliance with NEMA standard MG-1, Part 31.
- The standard efficiency fan motors are not intended for inverter duty and will not be warranted if so applied.
- On installations with variable frequency motors, do not operate the standard gear drives below 450 RPM motor speed (gear input speed). For speeds less than 450 RPM, a low speed option gear drive must be supplied.
- Continued operation at a resonant frequency condition will result in torsional vibrations within the gear, which can damage system components. The most common indicator of torsional vibrations is an unusual rumbling or grinding noise from the gear drive at a sharply defined speed. The noise will disappear when the speed is increased or decreased. This noise is not indicative of a defect but results when the vibratory torque exceeds the drive torque causing the gear teeth to separate and clash together very rapidly. On variable frequency applications, avoid operation close to a resonant speed by locking out resonant frequency ranges.
- At start-up, increase the variable frequency drive from 0 RPM to maximum motor speed. Gradually increase the speed and observe the unit for the onset of any unusual rumbling or grinding at specific speeds. These resonant speeds (+/- 10%) should be "locked out" by the variable speed drive. Continuous operation at resonant speeds can result in fan failure and possible personal injury or damage.
- Please refer to the manufacturer's variable frequency drive recommended start-up procedure for further information or consult with your local BAC Representative for any VFD applications. For projects with BAC controls, visit www.BaltimoreAircoil.com.

Remote Sump Application

The water level in the basin of the equipment designed for remote sump operation is a function of the circulating water flow rate; water outlet connection size, quantity and location, and outlet piping size and configuration. The remote sump unit is supplied without a water make-up assembly, and the basin operating level during remote sump operation is fixed.

Cold Weather Operation

BAC products can be operated at subfreezing ambient temperatures provided proper operating methods are established and diligently followed.

Inspection and Maintenance

- Carry out the frequent visual inspections and routine maintenance services during operation in subfreezing weather.
- Ensure all controls for capacity and freeze protection are set properly and functioning normally.
- Prevent excessively high water levels and possible overflow of the cold water basin due to over pumping, clogged strainers, or make-up valve malfunction.
- Resolve any icing condition that may severely develop to damage the unit or the supports or impair the system performance.

Fan Section Icing Protection

There are three basic operational methods which can be used to provide the system's required cooling: Temperature Setting, Fan Control, and Dry Operation*. The method of controls employed on a given application depends upon the climatic extremes which are expected, the variations in heat load that will be encountered, and the compatibility of the control system with other portions of the installation. Effective icing control in subfreezing ambient conditions will require a combination of these three methods.

***NOTE**: Dry Operation applies only to closed circuit cooling towers and evaporative condensers.

Temperature Setting

Low leaving fluid temperature promotes ice formation. During operation in subfreezing ambient temperatures, maintain the leaving fluid temperature as high as possible. Ensure the unit operates with the maximum possible heat load. The recommended minimum fluid temperature is:

- 43°F (6.1°C) for Crossflow Cooling Towers
- 42°F (5.5°C) for Counterflow Cooling Towers
- 50°F (10°C) for Closed Circuit Cooling Towers with water (non-glycol)
- 45°F (7.2°C) for Closed Circuit Cooling Towers with glycol

Fan Control

Reduce the unit capacity by cycling fans thus modulating the airflow through the unit. Rapid on-off cycles can cause the fan motor to overheat. Set the controls to allow a maximum of 6 on-off cycles per hour. Periodically, cycle the fans off to prevent ice formation and/or to melt ice that accumulates on the intake louvers or combined inlet shields and face of the fill.

Fan Cycling: Operate each unit with the highest thermal load it can handle, rather than evenly dividing the total heat load across all cells. During prolong periods, bypass the idle units and drain the basins.

Multi-Speed Motors: If the unit is equipped with 2-speed motors or BALTIGUARD™/BALTIGUARD PLUS™ Fan System, operation at a lower speed may be sufficient to prevent icing. When 2-speed motors are used, the motor starter should include a minimum 15 second time delay when switching from high to low speed.

Variable Frequency Drives: VFDs offer the most precise method of capacity control, by modulating fan motor speed. When using VFDs, avoid operating at or near "critical speeds." Units with VFDs require inverter duty motors.

In subfreezing ambient temperatures, cycle the fan off for 5 minutes every 15 to 20 minutes for each cell. If ice continues to build on the louvers, decrease the on-time. Observe inlet louvers of the towers every 4 to 8 hours.

NOTE: Modulating the water flow rate to the unit is NOT a recommended method of controlling cooling capacity.

Dry Operation (for Models VF1, VFL, VC1, VCA, VCL, and HXV)

One method of protecting fans from icing is dry operation. Dry operation of the closed circuit cooling tower or evaporative condenser protects fans from ice formation due to mist and splash from the cold water basin.

Coil Freeze Protection

Use an industrial grade inhibited glycol solution for protection against coil freeze-up. When the use of glycol is not practical, the system must be designed to meet both minimum flow and minimum temperature requirements.

- Recommended solutions are an industrial grade inhibited ethylene glycol or propylene glycol solution.
- The Product & Application Handbook provides the coil volumes for Models FXV, HXV, VF1, and VFL. Coil volume for CXV, VC1, VCL, and VCA condenser models using liquid cooling circuits is job specific.

Minimum Operation

When a glycol solution is not utilized, operate the system to meet both of the following conditions.

- Maintain the minimum recommended flow through the coil at all the times (see Table 5).
- Maintain a minimum heat load on the circulating fluid so that the temperature of the fluid leaving the coil will not fall below 50°F (10°C).
- To maintain the leaving fluid temperature at 50°F (10°C) when the process load is extremely light or shut off, apply an auxiliary heat load to the circulating fluid.

Table 1: Minimum Coil Flow

Model Number	Minimum Coil Flow (GPM)
FXV-4xx	75
FXV-Q44x	150
FXV-6xx	110
FXV-Q6xx, FXV-T6xx	220
FXV-288, F-288-2Tx, 364-x1x	275
FXV-364-2Tx, 364-xQx	550
HXV-6xx	110
HXV-Q6xx	220
VF1-009, VF1-018,VF1-027, VF1-036	50

Model Number	Minimum Coil Flow (GPM)
VF1-048	75
VF1-072	100
VF1-096, VF1-144N	125
VF1-144, VF1-216N	200
VF1-192, VF1-288N	250
VF1-288, VF1-432	400
VFL-012 thru VFL-048	65
VFL-072 thru VFL-096	125

Positive Closure Damper Hood and Insulation

The amount of auxiliary heat required can be substantially reduced by the use of a positive closure damper hood and insulation. The heat loss data can be found in the corresponding product section of this handbook.

Emergency Coil Drain

Do not drain the coil as a normal method of freeze protection. Frequent draining promotes corrosion inside the coil tube. However, draining is acceptable as an emergency method of freeze protection if the coil is not protected by a glycol solution. If the coil is not protected, an automatic drain valve and vacuum breaker are recommended to drain the coil if flow stops or fluid temperature drops below 50°F (10°C) when the ambient temperature is below freezing. Contact your local BAC Representative for guidelines on the installation of an emergency coil drain system.

- Further protection against coil freeze-up is possible with the installation of an alarm to alert personnel when the temperature of the fluid leaving the coil falls below 50°F (10°C).
- For evaporative cooling applications only, the glycol solution will maintain the leaving fluid temperature as low as 45°F (7.2°C). Contact your local BAC Representative for necessary precautions.

Basin Water and Internal Piping Freeze Protection

Cold Water Basin Protection

The basin water could freeze when the unit is shut-down and exposed to subfreezing ambient temperatures.

Indoor Sump: The ideal method of protection is a remote sump located in a heated indoor area. When the circulating pump stops, the water in the connecting piping will drain by gravity to this indoor sump.

Basin Heaters: On applications without a remote sump, provide heat to the cold water basin. Electrical immersion heaters, steam coils or hot water coils can provide the required function. Contact your local BAC Representative for details.

Electric Water Level Control: An electric water level control will maintain the proper water level regardless of the thermal load or variations in make-up water supply pressure. The two-position, slow closing solenoid valve provided in the BAC electric water level control package also minimizes valve freezing problems.

Heat Tracing: Heat trace and insulate all exposed water piping including pump piping below the overflow level, external header cleanout (PT2 only) and make-up water lines with electrical heater tape.

Piping Freeze Protection

- Eliminate all water in the optional EASY CONNECT® Piping Arrangement (Series 3000) and in all internal piping when the tower is idle.
- It is essential to drain water from the EASY CONNECT® Piping Arrangement and internal piping whenever the potential for freezing temperatures exits. Drain the water by using 1/2" NPT drain port located on the inboard side of the EASY CONNECT® Piping Arrangement.
- There are three recommended methods for draining the piping:
  - **Preferred:** Install a normally open 1/2" solenoid valve on the 1/2" drain connection of the EASY CONNECT® Piping Arrangement. Wire the valve in the pump circuit such that the valve closes when the pump is energized. Select the solenoid valve to operate with a minimum pressure differential of 0 psi, which is required to limit the static head imposed on the valve from the water column.
  - Install a 1/2" manual valve on the 1/2" drain connection of the EASY CONNECT® Piping Arrangement. Open the valve during the cold weather operation. Keep the valve closed during the warm weather to achieve full thermal performance.
  - Remove the 1/2" plug from the 1/2" drain connection of EASY CONNECT® Piping Arrangement during the cold weather operation. Reinstall the plug during the warm weather to obtain full thermal performance.

Corrosion Protection

BAC products are constructed of corrosion-resistant materials. The fill is made of a polyvinyl chloride (PVC), which requires no protection against rot, decay, rust or biological attack.

Other materials listed below are used in the equipment construction:

Galvanized Steel Components: Inspect the galvanized steel components for blemishes or corrosion. Wire brush and recoat the affected areas with a cold galvanizing compound such as zinc rich compound (ZRC).

Thermosetting Hybrid Polymer Components: Galvanized steel components protected with the Thermosetting Hybrid Polymer may develop scratches, scrapes or blemishes. Touch up these with a repair kit (BAC Part No. 16-133P). In the unlikely event that the damage is more extensive than simple scratches or minor blemishes, contact your local BAC Representative.

Stainless Steel Components: Inspect stainless steel components for signs of blemishes or corrosion. Clean with stainless steel wool as necessary. If more extensive corrosion is prevalent, contact your local BAC Representative.

Fiberglass Reinforced Polyester (FRP) Components: Series 3000, dual air inlet FXV, and CXV-T products are provided with FRP casing panels as standard. Inspect the casing panels for accumulation of dirt and clean them with soap and water as necessary.

TriArmor® Corrosion Protection System: Inspect components protected with the TriArmor® Corrosion Protection System for signs, deep scratches or blemishes, especially in areas with field penetrations. Touch these up with either rubberized polyurethane caulking such as Vulkem® or a repair kit available through BAC (BAC Part No. RK1015).

Pultruded Fiberglass Reinforced Polyester (PFRP) Components: Series 3000 Cooling Towers are optionally provided with PFRP hot water basins. Inspect the basin panels for accumulation of dirt and clean them with soap and water as necessary.

Corrosion and Treatments

- **Corrosion** – Red rust on steel components and "white rust" on galvanized surfaces will affect the longevity of the unit.
- **Scale Formation** – Scale not only reduces heat transfer and system efficiency, but also may lead to under deposit corrosion.
- **Biological Fouling** – Slime and algae formations may reduce heat transfer, promote corrosion, and harbor pathogens such as Legionella.

Since the quality of the ambient air and make-up water varies significantly from job site to job site, BAC strongly recommends obtaining the services of a competent water treatment specialist prior to the initial start-up of the evaporative cooling equipment. Additionally, to protect against the risk of Legionella contamination, never operate the cooling equipment without adequate biological control.

Corrosion and Scale Control

- To control corrosion and scale, maintain the water chemistry of the recirculating water within certain parameters. The specific measures required vary from system to system and are dependent on the chemistry of the make-up water, the metallurgy of the piping and heat transfer devices exposed to the recirculating water, and the temperatures at which the system will be operating.
- Bleed/blowdown, the continuous flow of a small portion of the recirculating water to a drain, is used to control the concentration of dissolved solids. On rare occasions, this may be adequate to control scale and corrosion. More often, however, chemical scale and corrosion inhibitors are necessary, which raise the allowable level of dissolved solids without the risk of scale and corrosion.
- Keep the chemically treated water within the guidelines given in Table 2. In cases where bleed/blowdown alone is being employed for corrosion and scale control, without chemical treatment, your water treatment specialist may recommend more conservative limits than those shown in Table 2.

Table 2: Quality Guidelines for Chemically Treated Circulating Water

Property of Water	Recommended Level
pH	6.5 to 9.0[1]
Hardness as $CaCO_3$	30 to 750 ppm[2]
Alkalinity as $CaCO_3$	500 ppm maximum[2]
Total Dissolved Solids (TDS)	1500 ppm maximum
Conductivity	2400 micromhos[3]
Chlorides	250 ppm maximum Cl (410 ppm maximum as NaCl)
Sulfates	250 ppm maximum
Silica	150 ppm maximum

Notes:

1. Galvanized steel units require passivation in order to prevent white rust (refer to passivation below).
2. Hardness and alkalinity limits may be exceeded under certain circumstances. Consult your water treatment specialist for recommendations.
3. The conversion factor used to determine conductivity is 0.625 (TDS = 0.625 x Conductivity).

Chemical Treatment Requirements

Chemical treatment programs must meet the following requirements:

- The chemicals must be compatible with the unit materials of construction as well as other materials used in the system (pipe, heat exchanger, etc.).
- Chemical scale and corrosion inhibitors, particularly acid (if used), should be introduced into the circulating water through automatic feeders. This should be done at a point in the system where total mixing and dilution occur, before reaching the evaporative cooling equipment. The preferred injection point for chemical scale and corrosion inhibitors is on the discharge side of the system circulating pump(s). These chemicals should not be batch fed directly into the units cold water basin or water distribution system, as this can severely damage areas directly contacted.
- When chlorine is added to the system, free residual chlorine should not exceed 1 ppm, except as noted in start-up and shutdown section. Exceeding this limit may accelerate corrosion.

Passivation

- Passivation is the formation of a protective, passive, carbonate layer on galvanized steel surfaces.
- On the newly installed units, to provide maximum protection from corrosion, take special measures to passivate galvanized steel surfaces.
- To ensure proper passivation of the galvanized steel, keep the pH of the circulating water between 7.0 to 8.2 for four to eight weeks after start-up, or until new zinc surfaces turn dull gray in color.
- If white deposits form on galvanized steel surfaces after the pH is returned to normal service levels, it may be necessary to repeat the passivation process.

NOTE: Stainless steel cold water basins and basins protected by the TriArmor® Corrosion Protection System or Thermosetting Hybrid Polymer do not require passivation. However, if the upper structure is galvanized steel, passivation is required.

Biological Control

- The warm, oxygen and nutrient rich environment inside evaporative cooling equipment provides an ideal environment conducive to the growth of algae, slime, and other micro-organisms. Uncontrolled, this can reduce heat transfer, promote corrosion, and promote the growth of potentially harmful organisms such as Legionella. To avoid biological contamination and minimize the risk of Legionella, initiate the biocide treatment program at start-up and continue on a regular basis thereafter in accordance with the treatment supplier's instructions.
- Bleed/blowdown or chemical treatment used for corrosion and scale control alone is not adequate for control of biological contamination.
- Introduce solid or granular biocides through a chemical "pot" feeder installed in parallel with the system circulating pump. Diluted liquid biocides may be added directly to the cold water basin.
- If ozone water treatment is used, at no point should concentrations exceed 0.5 ppm.
- Initial Start-up and Start-up Following a Shutdown Period:
  - To minimize the risk of biological contamination during a shut-down period of three days or more, it is recommended that the entire system (evaporative cooling equipment, system piping, heat exchangers, etc.) be drained.
  - To resume operation of a drained system and at initial start-up, clean all debris from the cold water basin and fill the system with fresh water. Then execute one of the following biocide treatment programs while operating the circulating pump and prior to operating the unit fans:
    - Resume treatment with the biocide that was used prior to shut-down. Then run the pump only while maintaining the maximum recommended biocide residual for a sufficient duration (residual and time will vary with the biocide) as recommended by the water treatment supplier. Start the fan only after this treatment period is completed.
    - Check the pH of the circulating water and, if necessary, adjust it to 7.0 - 7.6 pH. Then, running the pump only, treat the system with sodium hypochlorite to maintain a level of 4 to 5 mg/l (ppm) free chlorine (as Cl_2) over a 6 hour period. Test kits for measuring the free residual of chlorine are commercially available. Start the fan only after this treatment period is completed.
- When it is not practical to drain the system during shut-down periods, install a by-pass line with shut-off valves to permit the recirculating water to circulate throughout the system, including the unit basin, while bypassing the fill section of the evaporative cooling equipment (fans should remain off).
- Treat the system as per one of the above-described methods prior to restarting the unit.

System Cleaning

System Cleaning (for Models Series V and Low Profile V (VF1, VFL), HXV, and FXV)

With proper precautions, prior to start-up circulate an alkaline solution which can be used to clean condenser water systems through a closed circuit cooling tower. The necessary precautions include:

- Limit the duration of the cleaning to 1, or at the most 2 days.
- The temperature of the solution should never exceed 100°F (37.8°C).
- The maximum concentration of chemicals in the circulation solution should not exceed any of the following:
  - 5% Sodium Hydroxide
  - 5% Sodium Metasilicate
  - 2% Sodium Carbonate
  - 2% Tetra Sodium Pyrophosphate
  - 0.5% Trisodium Phosphate
  - 0.5% Sodium Nitrate
  - 5-10% Butyl Cellosolve

Coil Cleaning (for Models Series V and Low Profile V (VF1, VFL), HXV, and FXV)

Both the inside and outside of the heat exchange coil may require occasional cleaning. The chemicals used must be compatible with the materials being treated. For example, the standard coil outside is galvanized steel. The inside of the coil is black carbon steel. For finned coils, the coil cleaning must be careful not to damage the fins (outside of the coils) and the coils themselves. For specific recommendations on coil cleaning, contact a qualified consultant.

Weld Byproduct Cleaning (for Models CXV, VCL, VC1, and VCA)

The installation and manufacturing processes commonly used for field assembly of steel-piped systems may leave weld byproducts inside coils and connecting piping (especially in refrigeration systems). It is common practice to install filters and/or strainers that remove contaminants during initial system operation. Shortly after system startup, the filters and/or strainers should be cleaned or replaced.

Water Treatment

A proper water treatment program, administered under the supervision of a competent water treatment specialist, is an essential part of routine maintenance to ensure the safe operation and longevity of evaporative cooling equipment, as well as other system components.

Bleed Rate

- In evaporative cooling, evaporation of a small portion of the recirculating spray water as it flows through the equipment causes the cooling effect. As this water evaporates, the impurities originally present remain in the recirculating water. The concentration of the dissolved solids increases over time and can reach unacceptable levels.
- In addition, airborne impurities are often introduced into the recirculating water. If these impurities and contaminants are not effectively controlled, they can cause scaling, corrosion, and sludge accumulations that reduce heat transfer efficiency and increase system-operating costs, potentially shortening the useful life of the equipment.
- The degree to which dissolved solids and other impurities build up in the recirculating water may be defined as the cycles of concentration. Specifically, cycles of concentration is the ratio of the concentration of dissolved solids (for example - chlorides, sulfates, etc.) in the recirculating water to the concentration of the same material in the make-up water.
- In order to optimize heat transfer efficiency and maximize equipment life "bleed" or "blowdown" a small amount of recirculating water from the system. This controls the cycles of concentration to maintain the quality of the recirculating water within the guidelines given in Table 2, on Page N105.
- Replenish the "bleed" water with fresh make-up water, thereby limiting the build-up of impurities.

- Bleed/blowdown:
  - o Accomplish the bleed automatically through a solenoid valve controlled by a conductivity meter. The conductivity meter set point is the water conductivity at the desired cycles of concentration and should be determined by a competent water treatment expert.
    Note: The solenoid valve and conductivity meter must be supplied by others.
  - o Alternatively, use a bleed line with a valve to continuously bleed from the system. In this arrangement, adjust the rate of bleed using the valve in the bleed line. Measure the rate of bleed by filling a container of known volume while noting the duration. Check the bleed rate and water quality periodically to ensure that adequate control of the water quality is being maintained.

Bleed Line Calculations: Bleed rate is determined by the following formula:

$$\text{Bleed Rate} = B = \frac{E}{(n-1)}$$

Where: B = Bleed Rate (GPM)
E* = Evaporation Rate (GPM) = Q (GPM) x R (°F) x .001
Q = Process Fluid Flow Rate (GPM)
R = Range
n = Number of Cycles of Concentration = CR/CM
CR = Concentration in Recirculating Water
CM = Concentration in Make-up Water

* **NOTE:** The evaporation rate (E) can be determined by any one of the following methods:
1. The evaporation rate is approximately 2 GPM per 1 million BTUH of heat rejection.
2. The evaporation rate is approximately 3 GPM per 100 tons of refrigeration.
3. Evaporation Rate = Q (GPM) x R x .001 (as shown in the example above).

The following example illustrates a bleed rate calculation:

Given:
- Closed Circuit Cooling Tower
- Process Fluid Flow Rate = 800 GPM
- Maximum Allowable Chloride Concentration = 250 ppm
- Concentration of Chlorides in Make-up Water = 45 ppm
- Range = 10°F

Find: Bleed Rate

Solution: So in this case,

$$E = Q \times R \times 0.001 = 800 \times 10 \times 0.001 = 8 \text{ GPM}$$

$$n = \frac{CR}{CM} = \frac{250 \text{ ppm}}{45 \text{ ppm}} = 5.55$$

$$\text{Bleed Rate} = B = \frac{E}{(n-1)} = \frac{8 \text{ GPM}}{(5.55-1)} = 1.75 \text{ GPM}$$

Therefore, in this case we must bleed approximately 1.75 GPM to limit the concentration of impurities.

NOTE: This example focuses on a single parameter (chloride concentration) of water only. The bleed rate required for a system (when evaluating more than one parameter) is the highest bleed rate required to keep all parameters within recommended limits.

Basin Heater and Stand Alone Heater Control Panel[1]

Basin Heater

The cold water basin heater consists of one or more electric immersion heaters. It is designed to prevent the cold water basin from freezing during shutdown or standby. The heaters are sized for the specific application. The heating element has an enclosure that is suitable for outdoor use.

WARNING: The basin heater is not designed to prevent icing during unit operation.

Operation

Ensure that the heating element is completely submerged before energizing the main disconnect. For installations that have a BAC Controls Enclosure, please contact your local BAC Representative. For installations that use a BAC Heater Control Panel, see below.

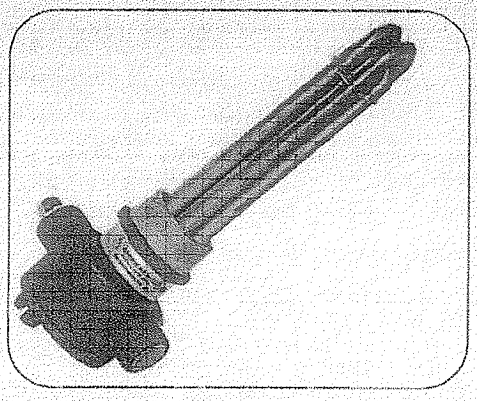


Figure 1 - Basin Heater

Stand Alone BAC Heater Control Panel

The heater control system consists of a heater control panel and a combination temperature/liquid level sensor. The stainless steel 1/4" NPT sensor has an on/off relay output that de-energizes the heaters whenever the basin liquid temperature is above 45°F (7.2°C), or whenever the sensor probe is not fully submersed. The control panel has an enclosure that is suitable for outdoor use.

NOTE: The heater control panel temperature/low level control can only be used with the supplied combination temperature/liquid level sensor probe. Please contact your local BAC Representative for replacement parts.

The control system utilizes a 24V combination temperature/low liquid level control sensor, which is powered by a transformer in the control panel. When the sensor provides a 24V signal back to the control panel, the panel then sends a 24V control voltage to the magnetic contactors. When energized, the magnetic contactors supply line voltage to the heaters.

Operation

Ensure that the heating element is completely submerged before energizing the main disconnect. The combination temperature/low level control is preset to energize the heater at 45°F (7.2°C), but will not energize if the water level is too low or if the water temperature is above 45°F (7.2°C).

WARNING: Disconnect the heater control panel and tag the circuit out before performing the following steps.

Testing heater when water temperatures are above 45°F (7.2°C):

- Disconnect the heater control panel and tag out circuit.
- Remove the heater control panel cover.
- Remove the sensor wires connected to terminals T1 and T2 on the combination temperature/low level control and isolate them.
- Install the 1.5K ohm test resistor supplied with the heater control panel (in bag on outside of cover) across terminals T1 and T2.
- Install the heater control panel cover.
- Energize the system. You should hear the contactors close, energizing the heater.
- After operation, de-energize the circuit, remove the resistor and place it back in the storage bag. Check all connections, reconnect sensor wires per the wiring diagram to terminals T1 and T2, replace the cover, and place the system back in service.

WARNING: Do not operate the system unattended or for extended periods of time during test mode (resistor across terminals T1 and T2). Operation in water temperatures above 45°F (7.2°C) could damage the unit.

1. Reprinted with permission from INDEECO O&M #76-2000-83-5.

Operation when sensor probe is encased in ice:

- De-energize the heater control panel and tag circuit out.
- Remove the heater control panel cover.
- Install a jumper wire across terminals G1 and G2 on the combination temperature/low level control circuit board.
- Install the heater control panel cover.

WARNING: Do not operate the system unattended or for extended periods of time with G1-G2 jumpered. A low liquid level condition could occur and the system will not shut off which could result in damage to the heater and unit.

- Energize the system and listen for the contactor closing.
- Operate the system until the ice is melted around the probe.
- After operation, de-energize the circuit, remove the jumper, check all connections, replace the cover, and place the system back in service.

Electronic Vibration Cutout Switch[2]

General

The PMC/BETA electronic switches utilize a solid state crystal accelerometer which provides an electrical output when it is deformed by the vibration forces. The output is electronically converted to a signal proportional to velocity. This signal is compared with a preset limit and triggers a solid state relay if the limit is exceeded. There are no moving parts in the 440 vibration switches except when configured with mechanical relays.

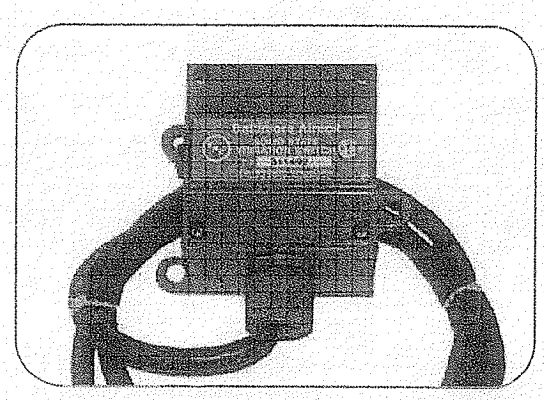


Figure 2 - Electronic Vibration Cutout Switch

An important feature of the PMC/BETA switches is the built in time delay. This prevents triggering of the alarm or shutdown functions from transient increases in vibration levels. It also avoids shutdown due to transitory vibrations occurring during start-up. 3 second alarm trip delay is standard, however time delays are independently adjustable in the field over a range of 2 to 15 seconds.

Operation

Testing

"Test" position on the shutdown dial sets a minimum set point so that any vibration will cause trip condition. Light will come on immediately, and trip will occur after duration of the time delay, proving that the complete system is operational. If test position is maintained for less than the duration of the time delay, trip will not occur, thus permitting system test without shutdown.

Remote Reset

Connection between terminals 5 and 6 latches triac output in the alarm state after setpoint is exceeded. Operating the connection will reset the output to non-alarm state.

2. Reprinted with permission from METRIX Instrument Company documentation for "Electronic Vibration Switch PMC/BETA 440 and 450".

Instructions for Installing Field Connections (Equalizer/Bypass/Outlet) on a Cold Water Basin with the TriArmor® Corrosion Protection System

BAC recommends adding a flange connection for field installed equalizers, bypass and outlet connections. Please order the following supplied prior to unit shutdown.

Table 3: Supplies for Installing Field Connections

Supplies Provided by BAC	Recommended Supplies Provided by Others
Template for the connection with bolt holes	Stainless Steel threaded shoulder bolts
Type 304 stainless steel backing ring with gasket	150 lb flange – please weld any piping to the flange prior to installation
Vulkem® caulk	Gasket for the outside of the cold water basin

1. Use the BAC template provided with the accessory to layout and mark the hole pattern on the exterior of the cold water basin.
2. Drill a pilot hole from the outside of the cold water basin to the inside of the cold water basin.
3. On the inside of the cold water basin:
   a. For connections 3" or less, score the TriArmor® Corrosion Protection System with a hole saw as shown in Figure 3.
   b. For connections 3" or greater, proceed to step 4 and 4b.

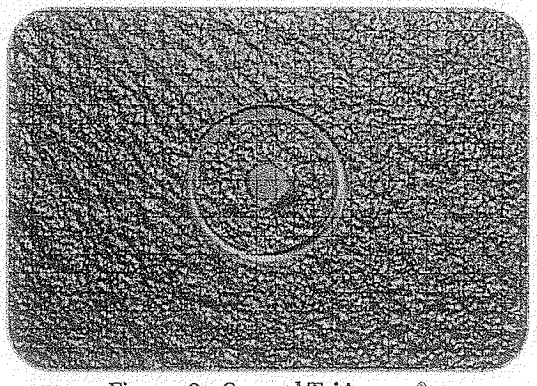


Figure 3 - Scored TriArmor®

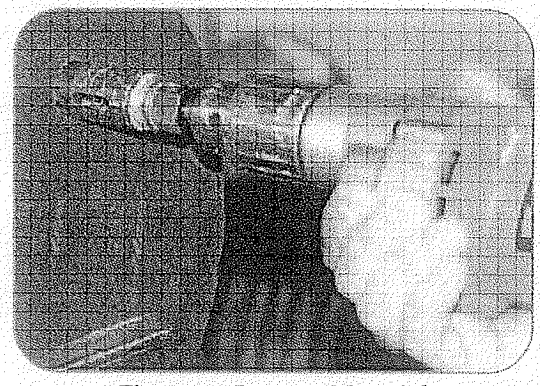


Figure 4 - Remove Material

4. Cut the hole from the outside of the cold water basin.
   a. Use a hole saw or a step drill bit for smaller connections 3" or less as shown in Figure 4.
   b. Use a reciprocating saw or a Sawzall® for larger connections 3" or greater.
5. Position the BAC supplied stainless steel backing ring, gasket to the inside of the cold water basin.
6. Position the flange to the outside of the cold water basin.
7. Bolt the flange and the stainless steel backing plate together using stainless steel bolts.
8. Seal any exposed galvanized steel of the connection inside the cold water basin with Vulkem® caulk as shown in Figure 5.

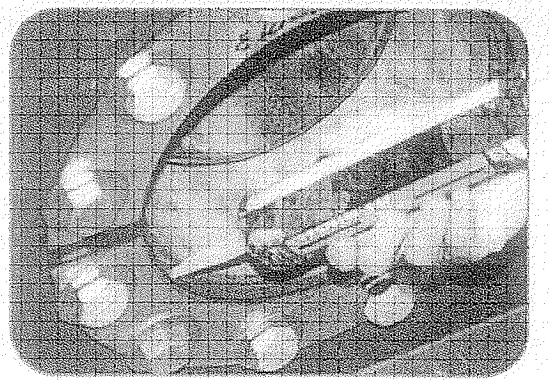


Figure 5 - Caulk Exposed Galvanized Steel

Factory Authorized Parts

- Baltimore Aircoil Company maintains a stock of common replacement parts at all times.
- Many BAC Representatives also have BAC replacement parts stocked in their warehouses.
- These parts are designed and built specifically for BAC units and assure BAC's customers of:
  - Guaranteed performance
  - Immediate availability in most cases
  - Original equipment quality
  - Local assistance with service problems
- All factory-authorized parts are guaranteed for 1 year and their use will ensure continued maximum performance from your BAC equipment.
- Parts shipment is normally made within 3 business days after receipt of an order.
- In emergency situations, shipment can usually be made within 24 hours.
- To order factory authorized parts, contact your local BAC Representative. You can locate your local BAC Representative by the label next to the unit nameplate, by calling (800) 896-8497, or via the Internet at www.BaltimoreAircoil.com/repfinder. Be sure to include the unit serial number when ordering any parts.
- To facilitate service of your BAC unit, it is suggested that some of the following spare parts be kept on hand:
  - Make-Up Float Ball – large diameter
  - Valve Seat for Make-up Valve – elastomer seat for positive shut off
  - Fan Shaft Bearings – grease-lubricated ball bearings with special moisture proof seals and integral slinger rings designed specifically for evaporative cooler applications.
  - Fan Belt – solid backed, multi groove, specially compounded, neoprene polyester drive band.
  - Spray Nozzle and Grommet Kit – large diameter plastic metering nozzles engineered for optimum water distribution
  - Access Door Gasket
  - In addition to the repair parts, BAC also offers many retrofit kits designed to enhance safety and access, ease of maintenance/operational flexibility and provide additional capacity and capacity control.
- Finally, your local BAC Representative usually stocks common wear items for immediate delivery, and is available to inspect your unit to ensure it is in proper operating condition.
- Please record your unit's model number and serial number (as they appear on the unit nameplate) on the front and back cover. This will help ensure the quickest, most accurate response to your inquiries.

Baltimore Aircoil Company

Cooling Towers

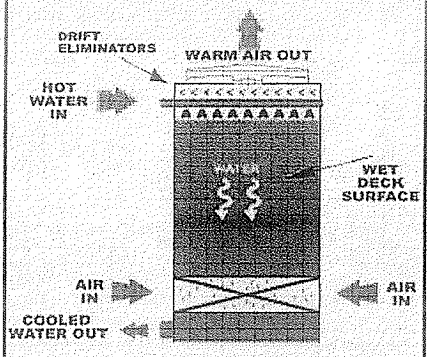
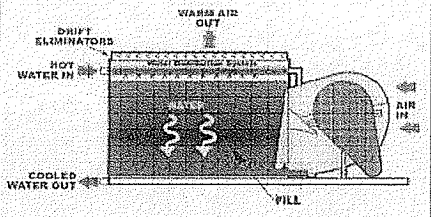
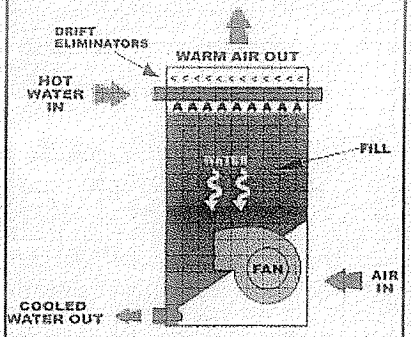
Series V

Series V Cooling Towers deliver independently verified, fully rated thermal performance over a wide range of flow and temperature requirements. The Series V can be installed indoors. It is also suitable for high temperature applications with entering water temperatures of up to 170ºF. The Series V minimizes sound levels and installation costs, provides year-round operating reliability, and simplifies maintenance requirements.

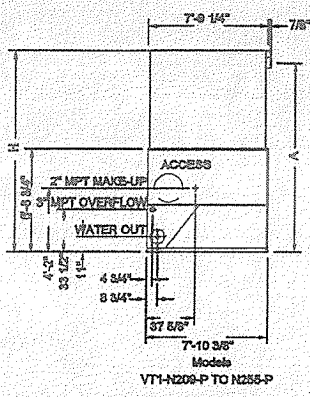
Low Profile Series V Cooling Towers deliver independently verified, fully rated thermal performance over a wide range of flow and temperature requirements. The Low Profile Series V can be installed indoors and can accommodate limited ceiling or enclosure heights compared to other cooling towers. It is also suitable for high temperature applications with entering water temperatures of up to 170°F. The Low Profile Series V minimizes sound levels and installation costs, provides year-round operating reliability, and simplifies maintenance requirements.

Product Spotlight

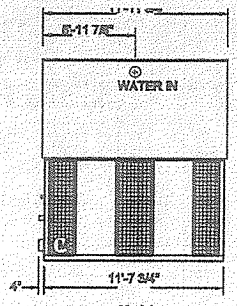
Single Side Air Inlet (/english/products/cooling-towers/series-v/benefits#ac1)
Sound Sensitive Alternatives (/english/products/cooling-towers/series-v/benefits#ac2)
Suitable for Indoor or Outdoor Installations (/english/products/cooling-towers/series-v/benefits)
Low Profile Models Available (/english/products/cooling-towers/series-v/benefits#ac3)
BALTIGUARD™ PLUS Fan System (/english/products/cooling-towers/series-v/custom-features-options#ac1)
High Temperature Applications (/english/products/cooling-towers/series-v/benefits#ac4)

PT2	Series V	
	VTL	VT0/VT1
		
Counterflow	Counterflow	Counterflow
Pressurized	Pressurized	Pressurized
Axial fan, induced draft	Centrifugal fan, forced draft	Centrifugal fan, forced draft
99 - 502 Nominal Tons 297 - 1506 GPM at 95°F/85°F/78°F	16 - 272 Nominal Tons 48 - 816 GPM at 95°F/85°F/78°F	12 - 1,335 Nominal Tons 36 - 4,005 GPM at 95°F/85°F/75°F
140°F (60°C) Standard Fill; 150°F (65.6°C) with alternative fill material	130°F (54.4°C) Standard Fill; 170°F (76.7°C) with alternative fill material	130° F (54.4°C) Standard Fill 170°F (76.7°C) with alternative fill material
Small to medium HVAC and industrial applications Ideal for Installations with limited footprint Counterflow unit Replacements	Small HVAC & industrial applications Installations with extremely low height requirements Indoor installations High temperature industrial applications Tight enclosures & installations requiring a single air inlet	Small to medium HVAC & industrial applications Indoor applications High temperature industrial applications Tight enclosures & installations requiring a single air inlet

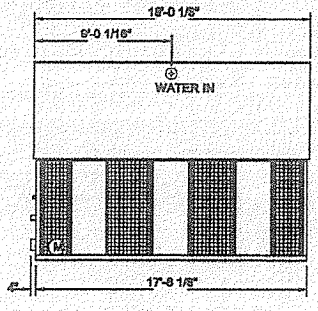
VT1 Engineering Data



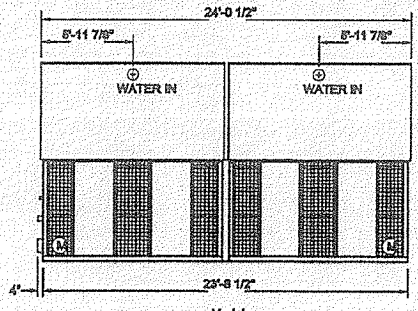
Models
VT1-N209-P TO N255-P



Models
VT1-N209-P TO N255-P



Models
VT1-N301-Q TO N395-R



Models
VT1-N418-P TO N510-P

Model Number	Nominal Tonnage[1]	Motor HP	Airflow (CFM)	Weights (lbs)			Dimensions			Connections	
				Operating	Shipping	Heaviest Section	A	H	B	Inlet	Outlet
VT1-N209-P	209	40	66,300	9,180	5,350	3,300	10' 7-5/8"	11' 5-1/8"	12"	8"	8"
VT1-N220-O	220	30	53,100	9,490	5,660	3,110	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N240-P	240	40	57,950	9,680	5,850	3,300	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N255-P	255	40	55,900	10,380	6,550	3,300	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N301-Q	301	50	86,150	13,380	7,530	4,590	10' 7-5/8"	11' 3-3/8"	12"	8"	8"
VT1-N325-P	325	40	77,450	14,110	8,260	4,550	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N346-Q	346	50	83,050	14,150	8,300	4,590	12' 4-5/8"	13' 2-1/8"	12"	8"	8"
VT1-N370-Q	370	50	80,150	15,130	9,280	4,590	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N395-R	395	60	84,750	15,250	9,400	4,710	13' 9-3/8"	14' 6-7/8"	12"	8"	8"
VT1-N418-P	418	(2) 40	120,600	18,490	10,680	6,580	10' 7-5/8"	11' 3-3/8"	11"	(2) 8"	10"
VT1-N440-O	440	(2) 30	106,200	19,110	11,300	6,200	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N480-P	480	(2) 40	115,900	19,490	11,680	6,580	12' 4-5/8"	13' 2-1/8"	11"	(2) 8"	10"
VT1-N510-P	510	(2) 40	111,800	20,890	13,080	6,580	13' 9-3/8"	14' 6-7/8"	11"	(2) 8"	10"

Do not use for construction. Refer to factory certified dimensions.

Notes:

1. Operating weight is for the tower with the water level in the cold water basin at overflow.
2. Unless otherwise indicated, all connections 6" and smaller are MPT. Connections 8" and larger are beveled for welding.
3. Fan horsepower is at 0" external static pressure.
4. Nominal tons of cooling represents 3 GPM of water cooled from 95°F to 85°F at a 78°F entering wet-bulb temperature.
5. Unit's casing section is the heaviest section.